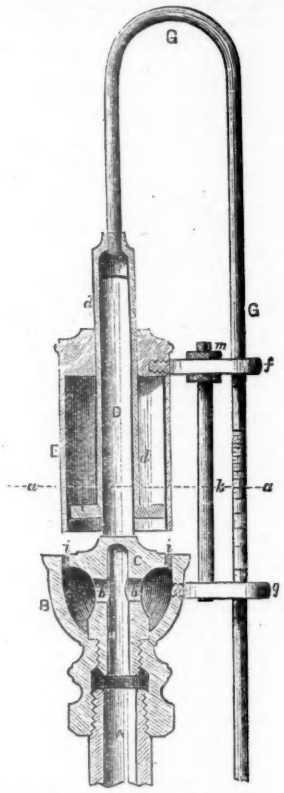
RAILROAD GAZETTE

SATURDAY, FEBRUARY 22, 1873.

"Modulating" Steam Whistle.

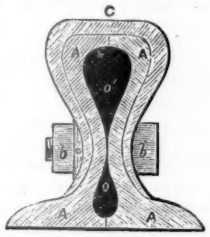
This device will commend itself to people with weak nerves. It consists, as shown by our engraving, of an ordinary steam



whistle arranged with a piston *F*, inside of the cup *E*. This can be moved up or down by the hollow stem *d*, and the rod *G* which modulates the sound of the whistle to the higher or lower notes. The piston may be operated from any distance below by means of a rod at the pleasure of the operator. A scale of notes may be placed on the rod so that by moving it a tune may be played—so says the inventor in his patent specifications. His name—Garrett S. Nevins, of Bushnell, Illinois.

Improved Compound Rail.

Mr. James B. Johnston, of New York City, has conceived and patented this idea. It consists of two sections, *A*, *A*, *A*, *A*,



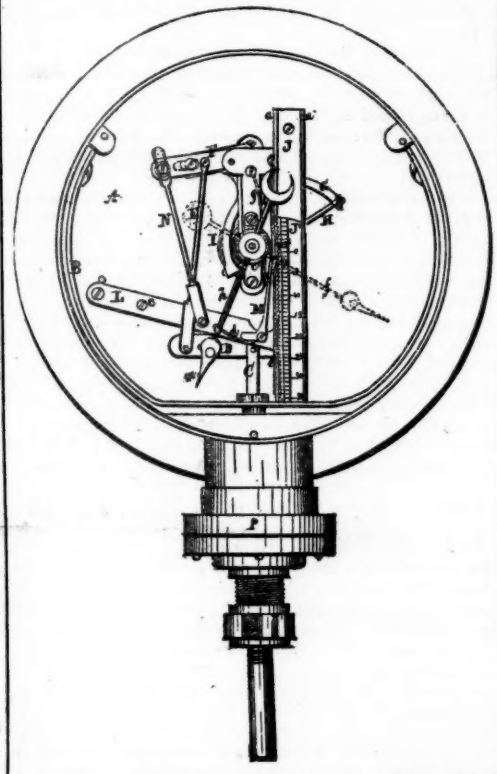
which are arranged in relation to each other so as to break joints. These are enveloped by a steel cap, *C*, which extends the whole length and covers the joints of the two sections, *A*, *A*, *A*, *A*, and is bolted to them as shown.

Holt's Registering Steam-Gauge.

This engraving represents an invention of Mr. John P. Holt, of Cleveland, Ohio, which he describes in his patent as follows:

The drawing represents a shell, in which the mechanism of the gauge is arranged, and which consists in part of the spring *B*, stem *C*, lever *D*, link *E*, adjustable arm *F* attached to the arm of the bow *G*, chain *H* connected to the cone on the index-spindle, coiled spring *I*, dial-plate, and pointer. In combination with the above-specified devices, and which are intended to indicate the pressure of steam, I have arranged to co-operate therewith a device for showing the excess of steam carried by the boiler over the prescribed maximum number of pounds, so that the inspector of boilers shall become aware of the fact and the number of times that such excess may have been indulged in. Said device consists of the following parts: *J* represents a plate having upturned edges *a*, between which is fitted loosely, so as to slide easily on the plate, a scale, *J'*, read from the top downward. On the inner edge of the scale is cut a series of notches, *f*, the purpose of which will presently be shown. *L* is a lever, pivoted at the point *c*. To the inner end of said lever is pivoted a pawl, *M*, the upper end of which is made to engage with the notches in the side of the scale *J'*, as shown, and which is held in engagement therewith by a spring, *d*, pressing upon the arm of the pawl. Between said pawl and the teeth of the scale is a spring, *e*, the lower end of which is secured to the side of the plate *J*, whereas the upper end is made to engage the teeth of the slide immediately below the engagement thereof by the pawl, as shown in the drawing. The dotted lines *f* indicate a pointer or index. Said pointer is connected to a toothed wheel *c'*, with which is made to engage the lower end of a spring-pawl, *g*, whereby the wheel and index are prevented from turning backward, but does not interrupt their forward movement. Said pointer is the tell-tale pointer, which indicates the excess of steam that may have been carried by the boiler above a certain number of pounds. Said pointer and wheel are not fixed to the spindle, but simply revolve loosely theron, whereas the pointer *h*, immediately above it is fixed to the spindle in a permanent manner, and which pointer is the one to indicate the steam pressure. The lever *L* above referred to is attached to the adjustable arm *F* by a slot in the end of the link, through which a screw is inserted loosely, so that it can freely slide therein.

The operation of the device is as follows: The first, that which indicates the pressure of steam, is actuated by the steam pressure exerted on a button inclosed in the part *P*, the steam being admitted through a pipe attached thereto instead of the screw *Q*, which is now only used in order to operate the mechanism by hand. The pressure of the steam forces upward the stem *C*, referred to, connected to the lever *D*. This upward movement of the stem also forces up the spring *B*, also the lever *D*, and also the adjustable arm *F* attached thereto by the link *E*. This upward movement of the arm *F* causes the bow *G* to rotate the spindle to which the point *h* is fixed, thereby turning it around on the face of the dial *R* from zero, to which it points, to any number above on the scale, as the pressure of the steam may be, as 20, 40, 50, 60, etc., indicating the pounds pressure of steam by those figures. Let it be supposed that 60 pounds of steam is allowed by the inspector to be carried as the maximum pressure; this amount of pressure, as a consequence, will carry the pointer around to 60 on the dial. Now, in order that the inspector may know that no higher than 60 has been used, or may have been used, and the number of times that the steam has been in excess of that num-

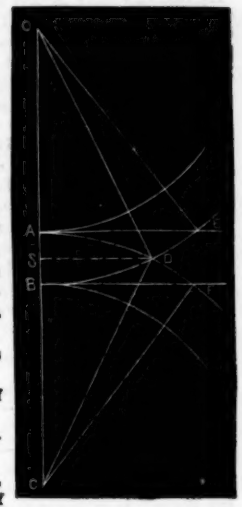


ber of pounds is the purpose of the device above last described, and which it will do as follows: As the pressure-pointer *h* moves around from zero, it carries with it the tell-tale pointer immediately beneath it by means of a point, *m*, projecting upward from the end of the tell-tale pointer, so that the pressure-pointer will come in contact with it as it moves around and upward, but not when the pointer returns back toward zero. The two pointers, as shown in the drawing, point to the zero. The lower or tell-tale pointer is not seen, as it is directly below the pressure one, but which, however, is indicated by the dotted line *f*. This pointer is carried along by the pointer *h* to 60, the prescribed degree of pressure, and where it will remain, as the spring-pawl *g*, prevents it from returning when left by the pointer *h*. In the event that more than 60 pounds steam is used, then the pointer *h* will rise above the 60 and carry with it the pointer *f*, which will there remain, as it cannot return by reason of the pawl *g*, thereby indicating that an excess of steam above 60 has been used once, but it may have been used in this degree of excess many times, but to no greater degree of excess; but the tell-tale pointer indicates but one excess, as it is not moved further along by the pressure-hand unless the first excess is exceeded by a second, and so on. Therefore to learn the number of times that the first degree of excess has been repeated, or any degree, the scale *J* is introduced, which operates as follows: As above said, let 60 be assumed as the maximum pressure, and that both of the pointers have been once to that number; now, should the pressure-hand go beyond 60 it will carry with it the tell-tale hand, which will remain there for the reason aforesaid. Now, in carrying the tell-tale hand this distance, the lever *L* is raised by means of the slotted link *N*, as the adjustable arm *F* rises so far as to bring the pin to the extreme end of the slot; it will therefore lift up on the link, and thereby raise the end of the lever *L*. As the lever rises it pushes upward the pawl *M*, and as a consequence the sliding scale *J'* goes with it by virtue of the engagement of the pawl in the notches on the edge of the scale. The ascent of the scale will be one degree or notch at a time, as the pawl is disengaged from the slide by a brake or push-off, *m'*, against which the end of the pawl will strike, and be thereby pushed from its engagement with the notch. The slide is prevented from falling down in consequence of the disengagement of the pawl therewith by means of the check *e*, which holds up the slide when the pawl is not engaged with it. The adjustment of the pointers is such that each time the pressure-hand goes beyond the 60, the assumed maximum pressure, the lever *L* will be actuated, thereby pushing up, as above described, the scale one notch, and one only, as the brake will push off the pawl from the slide when it is raised one degree or notch. It will be obvious that, by this means, the exact number of times that the pressure of steam is raised above the standard point will be made known by the slide, although the distance above the standard point is not more than one degree, for the adjustment of the link *N* and the pointer is so timed that the link and lever will be lifted by the arm *F* at the moment that the pressure-hand passes the point of maximum pressure, and which will be indicated by the scale and pointed out by the finger *n*, projecting from the side of the opening in the face of the dial-plate.

Contributions.

Locating Frogs—Three Throws.

On a Straight Line, when the Turnout Curves are in Opposite Directions.—The two main frogs at *E* and *F*, as also all distances dependent on them, may be found by my last article. It only remains to find the size of the frog at *D*, with the distances *AD* and *BD*.



The two turnout curves should always use the same size of frog at *E* and *F*, when the curves turn in opposite directions, so as to give the same length of switch rail for a given throw. On a straight line we would then have the radii equal, which, however, would not be the case on a curve.

Supposing, therefore, the frogs equal, $n = n$.

Let us denote the number of the frog at *D* by *b*.

1st. *D* is exactly in the middle of the track.

2d. If, in the triangle *COD*, we determine the cotangent of one-half of the exterior angle of the sides *OD* and *CD*, and remember that

$$\cot \tfrac{1}{2}D = 2b$$

we will find:

$$2b = \sqrt{\frac{r^2}{rg + \frac{1}{4}g^2}}$$

Writing for r its value $2gn^2$,

$$4b^2 = \frac{4g^2n^4}{2g^2n^2 + \frac{1}{4}g^2}$$

or,

$$b^2 = \frac{4g^2n^4}{8g^2n^2 + g^2} = \frac{4n^4}{8n^2 + 1} \text{ correctly.}$$

Now 1 in the denominator can be dropped, as of no consequence in the presence of n^2 and n^4, or,

$$b^2 = \frac{4n^4}{8n^2} = \tfrac{1}{2}n^2$$

whence,

$$b = n\sqrt{\tfrac{1}{2}} = .707n$$

3d. $AD = BD = \frac{1}{2}g\sqrt{8n^2 + 2}$, or, neglecting the 2, we have $AD = 1.414ng =$ (for $g = 4.7$) $6.546n$. The distance $SD = \frac{1}{2}g\sqrt{8n^2 + 1}$, or, neglecting the 1, $= 1.414ng =$ (for $g = 4.7$) $6.546\ n$. The above apply equally whether the main line is straight or curved.

The last case is thus demonstrated:

$$SD^2 = DC^2 - SC^2 = (r + \tfrac{1}{2}g)^2 - r^2 = rg + \tfrac{1}{4}g^2$$
$$= 2g^2n^2 + \tfrac{1}{4}g^2 = \tfrac{1}{4}g^2\ (8n^2 + 1)$$

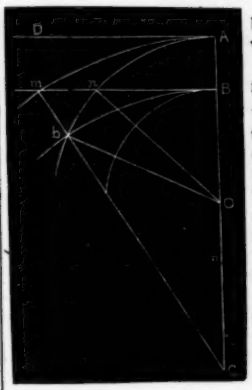
or,

$$SD = \tfrac{1}{2}g\sqrt{8n^2 + 1}$$

$$AD^2 = SD^2 + SA^2 = 2g^2n^2 + \tfrac{1}{4}g^2 + \tfrac{1}{4}g^2 = g^2\ (2n^2 + \tfrac{1}{2})$$
$$= \tfrac{1}{4}g^2\ (8n^2 + 2)$$

or,

$$AD = \tfrac{1}{2}g\sqrt{8n^2 + 2}$$



Let us have a three-throw, both curves turning the same way.

Let m, n and b denote the frog numbers at the points where they are placed, then $m > n$. From mechanical difficulties, it will be necessary to take $b = m$, so that the head-block may work all right, *i. e.*, so that the switch rail will naturally lie on *Am* and will throw equally for *Ab* or *AD*. We can then find *Ab* and *Bb*, also *Bm*, etc., from the article in paper for February 1, and here have to find *n* and *Bn*.

Working from the triangle *bOC* in a similar manner to the last example, we will find, as an approximation close enough for all purposes of the engineer,

$$b = m = n\sqrt{2}$$

or,

$$n = \frac{b}{\sqrt{2}} = .707\ b$$

and, knowing *n*, we can apply our article in issue of February 1. The above applies equally to the case when the main line is straight or curved, provided the turnout curves turn the same way.

T.

"Timber Work on Railroads."

To the Editor of the Railroad Gazette:

As "Hoosier" has given his ideas somewhat at length on "Practical Field Engineering," I presume he will not object to a few comments.

Is it not possible that he has told of what he has seen and done, without studying carefully as to the best and most economical way of reaching the desired result?

Take for instance his article in your number of February 1, where he treats of "Timber Work on Railroads," in which sketches are given of forms of trestles. He seems to have neglected some of the important points, and certainly has not

studied economy or strength of material. Hardly a word has been said about "stringers," which are to hold up our trains, or of ties, except that they "must be selected with great care," etc. He evidently uses the short tie. Many engineers make the mistake of putting ties too far apart and only 8 feet long. Narrow bridges with few ties are a source of trouble when the road is turned over to the operating department, and many cars and engines would have escaped damage had the bridges been correctly built.

Now if Hoosier would put his bents 16 feet apart instead of 12½, make his caps 16 feet long, use four stringers instead of two, use ties 6 by 8 inches 16 feet long, placed 16 inches apart from center to center, he would have but little more timber and would have a bridge that would carry an engine should it run off the track. The cost of one engine over the side would pay the slight extra expense for many miles of road. His bents should have plank spiked on either side for braces.

In figuring for timbers 14 by 16 in the lower string of his two story bents, was the strength of material or strain studied? With bents 12½ feet apart, timbers 12 by 12 would sustain *safely* any load that could be run over the bridge.

There are some reasons why his corbel should not be braced as he proposes. The lower chord of his bridge should have its support *at* the pier and not in the middle of the panel. There should be no side strain on the pier, as would follow his brace; all the pressure should be down.

Many other points will bear criticism, but this will do for the present. X.

Practical Field Engineering.

NO. XVI.

TRACK-LAYING AND BALLASTING.

Although, as has been remarked under the head of "Locating Frogs," it is rarely the case that any part of the track-laying or ballasting of a railroad is done under the direct personal supervision of the field engineer, still a thorough knowledge of the details of such work is necessary to him, and it would be well for the builders of railroads if they would give this matter into the hands of practical engineers instead of entrusting it with unlettered road-masters and section-bosses. A good permanent way is the first requisite of a number one railroad. After some years of experience and careful observation, I do not hesitate to give it as my opinion that an ill tied, ill ballasted, badly gauged and aligned track is productive of greater loss of life and money than all the other mistakes—heavy grades, sharp curves, shaky trestles, ill constructed rolling stock—put together. It needs only a few miles' walk along the track of any one of a large number of our Western railroads to confirm this opinion in the mind of any competent person. You look up the line of the permanent way and see an irregular succession of lateral waves and vertical undulations of the rails, and the most careless glance discloses the alarming condition of the rail joints. Here the ends of the bars are flattened and "frazzled" into a brush of fine fibres; there the sides have splintered off, leaving the rail for several feet of its length with a top surface of scarcely more than an inch in breadth. If you see a train coming, the first thing that strikes your attention is the rolling and rocking of the engine as it rushes over these bent, strained, hammered, crushed rails. Presently, above the general roar, you can distinctly hear the regular pounding of the wheels as they cross the joints and kinks of the rails. You step aside, and as the train passes you observe a see-saw motion of the cross-ties, down on this side and up on that, accompanied by the sound of jerking and bumping machinery. You wonder how that train keeps out of the ditch, and it *is* owing more to good luck than anything else. Of course such a condition of a road which has been in operation for several years is not to be attributed altogether, or even in greater part, to the manner in which it was at first constructed; but experience and observation teach that it is much cheaper and easier to keep a well-constructed permanent way in repair than to rectify a "botched job."

SURFACE FINISH OF EARTHWORK.

The first step toward securing a good permanent way is to be sure the surface finish of your earthwork is well executed. The road-bed should be laterally level, and parallel to the grade line longitudinally. If from any cause the surface of the earthwork has been injured after it has been received from the contractor, it must be rectified before the cross-ties are distributed and aligned for track-laying.

DISTRIBUTION AND ALIGNMENT OF CROSS-TIES.

It is best to have all cross-ties of one class; but if ties of two or three grades of dimension have been received, care must be taken to lay each class separately; that is, if you put *one* tie of a certain grade under a pair of rails, *all* the ties under that pair must be of the same. Narrow ties, of course, present a less surface of resistance than broad ones, and consequently sink deeper into the road-surface under a certain load or pressure; therefore if narrow and broad ties are promiscuously laid together, the track will be unsteady on account of the inequality of resistance. Cross-ties should be laid at right angles to the direction of the rails in position on a tangent, and radially on a curve. The centre of each tie should be in the line of "track center." Each class of ties must be uniformly distributed, and special care should be taken that the rails have equal bearing on each side of the joint tie. A failure to strictly observe and adhere to the above simple rules, added to insufficient care in ballasting, is the principal cause of battered joints and splintered rails found on so many roads.

The field engineer should personally superintend the laying of ties on trestles and culverts, and because sawed ties are here used he must not take it for granted that there will be no variation in their dimensions. The placing and adzing down of these ties should be done by carpenters, or men skilled in the use of the tools necessary for the purpose.

RULE FOR THE SUPERELEVATION OF THE OUTER RAIL ON CURVES.

Pambour's formula for the superelevation of the exterior rail in curves is:

$$x = \frac{bv^2}{g}\left(\frac{1}{r} - \frac{1}{R}\right) \qquad (1)$$

in which x is the required superelevation.

b, the road gauge.
r, the radius of the curve.
R, the radius of motion on account of the inclination of the tire of the wheels.
g, the force of gravity at the earth's surface.
v, the velocity of train per second.

The formula is a general one. Its application to particular cases requires the following

EXPLANATION.

To find the least radius that can be used without superelevating the exterior rail in curves:

Let p = the breadth of the tire of the wheel.
d = the difference between the diameters of the inner and outer sides of the tire.
q = diameter of the wheel.
n = gauge of road.
m = space allowed on each side between the rails and the flanges of the wheels.
y = smallest radius. Then we have:

$$y = \frac{\frac{p}{d}qn}{m} \qquad (2)$$

From formulas (1) and (2) the following rule has been drawn:

To ascertain the proper superelevation of outer rail in curves.—From the least radius found by formula (2) subtract the radius of the curve. Divide the remainder by the radius of the curve and by the least radius; multiply the quotient by the gauge of the road, by the square of the velocity of the train in miles per hour and by .782; product will be the height in inches that you must raise the outer rail.

In practice, however, the great variation between the rates of speed of different trains run over the same road makes it quite impossible to apply the above rule *exactly*. The best the engineer can do is to approximate the proper superelevation, taking into consideration the rates of speed usually established on such a class of roads as his will belong to. It will then devolve on the resident engineer, assistant superintendent or road-master to watch the curves and rectify the superelevation if the rails by wearing should indicate a mistake. Some of our roads are constructed on the plan of elevating the outer rail one inch for each degree of curvature, others adhere more closely to the mathematical rule, and there are some having no rule but the "thumb rule," and even this *thumb rule* badly botched by ill controlled and uninstructed section hands.

BALLAST AND BALLASTING.

If the field engineer has charge of the track-laying and ballasting of his road, the procuring of *good ballast* is a matter he must attend to in person. Clear gravel, such as is found in vast quantities in many of the hills and stream bluffs of the Western States, is generally the cheapest and best available ballast for railroad purposes. This generally has to be hauled some distance on "gravel trains," and dumped along the line after the track is laid. Before this is done, the track should be put in as good order as possible, to prevent construction trains passing over it from bending and disarranging the rails. Ballasting a road is often quite expensive, and the engineer should look well to the manner in which it is done. A little care and watchfulness will often save great waste of labor and ballast. Where a cutting is through a bed of gravel, it may at first be taken out as narrow as possible and afterwards widened, using the material for ballast. Side tracks should be put in along the line of road at such points as offer good gravel, which tracks may be shifted as the material recedes.

HOOSIER.

Power Brakes in Congress—National Accident Reports.

WASHINGTON, February 10, 1873.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It is a rare occurrence that Congress awakens to the consideration of measures looking to the safety of human life, unless prompted thereto by some disinterested (?) philanthropist who has a cousin or brother-in-law who is desirous of serving his country as an inspector of steamboats, boilers or something of that kind; but the many and frequent railroad accidents, accompanied with great loss of life, have awakened a few thoughtful persons, members of Congress, too, to the necessity and propriety of a more general supervision of the conditions of safety of railroad passenger travel than is provided by State enactments, which are generally controlled by local considerations, and are at best but sectional in their provisions and lack that general applicability so essential to provide protection and uniform oversight to the safety of the traveling public throughout the extent of our railway system. And although the Hon. S. S. Cox advocates less national legislation, and the leaving to the States a more generous measure of State rights in local legislation, yet even he might comprehend that in this matter a national oversight would be conducive to the integrity of population. It is barely possible that members of Congress may have reached the conclusion that they are not especially carried in the hollow of His hand who heedeth the sparrow in his fall, and are exercised as to the hopeful future of their services, which may be precluded by the carelessness of railroad officials, and they be as physically killed by an overload of *rolling stock* as certain members of Congress have been politically killed by overloads of "capital stock," and their remains be "shoveled" up for burial.

In view of this necessity for national legislation, Hon. Andrew King, of Missouri, has introduced the following bill:

A BILL to increase the safety of human life upon railroads.

Whereas, The preservation of life and the protection of person is a paramount duty of Government; and whereas the loss of life and injury of person caused by casualties upon railroads in the United States is one of the increasing and alarming evils of our internal commerce: Therefore,

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled: 1. That on and after the 1st day of January, in the year of our Lord 1873, it shall not be lawful for any railroad company to run any of its passenger trains unless such trains are fully equipped with a power brake, to be operated from the locomotive, so as to place them completely within control of the engineer.

2. That any railroad company which shall not have equipped its passenger trains with a power brake at the time and in the manner directed in the foregoing section, or which shall thereafter run any of its passenger trains without being fully equipped with a power-brake, operated from the locomotive by the engineer, so that he can instantly apply the brakes to the wheels of every car throughout the length of the entire train, shall be liable in a fine to the United States in the sum of $50 for each and every day, or each and every trip of any distance, that any train shall be run without such equipments; and such company shall be further liable in double the amount of civil damages to the legal representative of the person killed, or to the person injured, the same to be ascertained by a court of competent jurisdiction.

3. That each railroad company in the United States shall make an annual report, ending upon the 30th of June of each year, showing the number of miles of road operated; the total number of passengers carried; the total number of passengers, employees, and other persons killed and injured, together with the character of the accident, whether by collision or otherwise, and the amount in dollars paid by the company for injuries to the person, by judgment of court or otherwise, for the year preceding the date of such report; which report, signed by the President of the company and by him sworn to before a notary public, shall be forwarded to the Bureau of Statistics at Washington, on or before the 30th of August of each year. It shall be the duty of the Secretary of the Treasury, in his annual report to the President of the United States, to include therein an abstract of all such railroad reports, for the information of Congress: *Provided*, That each and every such report, except as hereinafter directed, shall be a privileged communication, and shall not be evidence in any court whatsoever.

4. Any railroad company which shall fail or refuse to furnish such report annually to the Bureau of Statistics as above directed, upon information given to that effect by the Secretary of the Treasury to any court of competent jurisdiction, shall be liable to be restrained and enjoined from operating its road by a writ of injunction until such report shall be furnished in pursuance of this act. And the Secretary of the Treasury shall demand such report when the period shall have expired prescribed for filing the same in section three of this act.

5. That any person who shall sign and swear to a false report to be made in pursuance of section three of this act, shall on conviction thereof be adjudged guilty of a felony, and punished by imprisonment in a penitentiary for a period of not less than five and not more than ten years; and the false report, at the option of the court, shall be evidence on the trial of the person indicted or to be indicted for the offense named in this section. And the courts of the United States shall have exclusive jurisdiction of all cases arising under this act.

And in support thereof Mr. King introduced statistical tables in support of the following remarks:

"Great care has been taken to present this bill in such a manner that no well-founded objection can be raised against it. No boards are created, and no money is appropriated from the treasury. It simply directs that important statistical information touching the operation of railroads shall be rendered annually to the Bureau of Statistics, and that this information shall be transmitted annually by the President to Congress. On first reflection it may be thought that too much revenue or power is thrown into the hands of a single patentee or manufacturer; but a fair and candid mind will see that the field is open to all. If an inventor does not have a good practical power-brake, that is his misfortune; but because he has not it is no reason why this bill, aimed purely at the preservation of life and safety of person upon our railroads, should fail to become a law. Power-brakes have been put on one-sixth the roads of the country. Let them be placed upon all of them. I would not attempt to say whose brake should be used; I should do an injustice to myself and to railroad corporations to express any opinion in this matter, for I am not competent to judge whose brake is or is not entitled to merit. Let railroad officials do that; let them in their annual conventions call upon inventors to come forward and submit their devices to the test required, so that they may determine whose brake they will adopt.

"The system of 'through travel' may be thought to render it impossible to put this measure into effect. The public demand is safety first, speed and comfort afterward. We like to enter the cars here and alight at St. Louis without change. To do this a car has to pass over three or four railroads, and to be made up into as many different trains. But the answer to all this is, let the system be uniform, so that in a train of a dozen cars, each belonging to railroad companies in different sections of the Union, the power-brake system may be manageable just the same as if it were only the road and the cars of a single corporation."

[We abridge long extracts from this speech, including statements from various authorities as to the number of and fatality of railroad accidents in different countries in different years, showing out of 689,580,710 passengers carried in Great Britain and Ireland from 1852 to 1857, inclusive, 1,507 were killed and 2,964 injured; that in Great Britain from 1866 to 1869, inclusive, 958 passengers were killed and 3,269 injured, 439 of the killed and 394 of the injured being employees; that in the same country in 1870, 66 men were killed and 131 injured, and in 1871 12 were killed and 171 injured. Also in Austria, in 1871, on 4,510 (English) miles of railroad there were 796 accidents to trains, or one to 5¾ miles of road worked, and 225 other casualties, by which 195 persons were killed (118 employees). The accidents in Belgium from 1866 to 1869, inclusive, are quoted, and then follows tables for Pennsylvania, Massachusetts, New York and Ohio, from the State reports, very unskillfully arranged and compiled on various principles, so as to make it almost impossible to make any trustworthy deductions from them, the figures in some cases being evidently only for the fatalities from train accidents, while others include injuries to persons on the tracks, trespassers, etc. The speaker also recalls many of the more serious accidents which have happened in this country, including that at the Gasconade River bridge in Missouri in 1855, "in which slaughter my own life was saved only by a miraculous interference of divine Providence;" all of which, we suppose, are intended to give evidence of a fact which no one doubts—that a great many people are killed and wounded by railroad accidents, and that it is extremely desirable that these accidents should become fewer and less fatal.—EDITOR RAILROAD GAZETTE.]

"These facts cannot be laid before you, for the government has no means of informing the Congress, and even these few facts are gathered by chance. It is not for the interest of railroad companies to publish their casualties, and it is unreasonable to suppose that they ever will do it unless they are compelled to do so. In England the Parliament has enacted that all accidents are to be reported to a Board of Commissioners, although Lord Campbell's act, providing for compensation to families of persons killed by railway accidents, did not become a law till the year 1846, or until six years after the Board of Commissioners had been established. This Board is

clothed with plenary powers. It can inspect road-bed, rolling stock, locomotives, issue rules for the government and comfort of passengers, in short, the law regulating the entire management of railroads in England emanates from this Board.

"But the scope of this bill does not contemplate any such radical change in our present system. On the other hand, it only provides for what, in my judgment, is an immediate necessity—the greater preservation of life and protection of person. It is a very grave subject, even suggesting, much less legislating, upon changes and proposed improvements in the management of our railroads. And though to-day I would be glad to see it enacted that no stove or lamp should ever again be placed in a passenger car, compelling railroad companies instead to heat them by means of warm water circulated in pipes, or else by steam from the locomotive, and to light them either by candles or else by gas, as is done on the Pennsylvania Central Railroad, that, I concede, is not such an immediato necessity as would justify me in asking legislation to that end. And we give the railroad people credit for too much interest in the public welfare to believe that they will not make these important changes for our comfort and safety, as fast as they consistently can do so. But the protection of life and of person it is a paramount duty of Congress to preserve, and hence to pass any law demanded by the people which will lessen the casualties by collision, for nine-tenths of them can be averted by the exercise of inventive skill. We cannot leave this matter to the States. Some States would pass such a bill as is offered here, while other States would not, because their Legislatures are too much controlled by railroad influence. And if a State should pass such a law as this and the railroad companies resisted it, what would be the remedy? A repeal of their charters? Why did not Congress leave it to the States to pass laws that every steamboat should have a life-saving apparatus? If there is ten times greater railroad than steamboat travel, should not this bill to protect life upon railroads become a law upon the same humane principle as those laws were enacted which protect life upon steamboats? Why, the net revenue of the Baltimore & Ohio Railroad last year was over $5,000,000. It could fight the whole New England States in a legal controversy if the fight was founded purely on a money basis. Under that clause of the Constitution of the United States authorizing Congr ss to regulate commerce between the States, the constitutionality of this measure can safely rest. In no sense can this bill be said to interfere with, or to diminish the responsibility of railway companies to the public; the details of working, the management, the maintenance, or the increase from time to time of accommodation or of inventive appliances—these are all left to the sense of railroad officials, who alone are competent to act in such matters."

[The speech recites further, that the first power-brake was patented in the United States in 1847, and that up to the close of 1872 59 patents had been granted for such brakes, more than half of which were granted in the single year 1872, while seven companies have been organized in the United States since 1869 for the manufacture of such brakes. Tables are given to show that of 444 railroads in the United States and Canada, more than one-sixth are equipped with power-brakes. In England, from 1835 to 1866, there were patented 22 electric, 20 hydrostatic, 30 pneumatic and 54 steam brakes.—EDITOR.]

It should have been remarked, in a more systematic way, that such provision for safety on the part of the railway companies would be a reasonable insurance on the value of their own shares.

The following table exhibits the damages sustained by the New York railroads in 1871:

REPORT OF THE STATE ENGINEER OF NEW YORK ON RAILROADS FOR THE YEAR ENDING SEPTEMBER 30, 1871.

Page 36—Passenger Transportation.

Damages for injuries to persons	$252,567 73
And for property and for cattle killed	18,367 32

Page 37—Freight Transportation.

Damages for injuries to persons	93,422 59
And for property and for cattle killed	61,110 74
Total	$425,468 38
Of this sum the Erie Railway paid for injuries to persons	$71,506 54
And New York Central Railroad paid	101,424 24
	$172,930 78

or more than one-third of the entire amount.

If but these losses were prevented by the use of power-brakes, the value of stocks would be sensibly increased,* by that evidence of good, sound management. ENGINEER.

Important Freight Agreement.

For a considerable time past the freight agents of the New York Central, Pennsylvania Central, and Erie railroads have been attempting to settle the freight rates on a uniform basis. Nominally a uniform rate was charged, but not actually. The basis was $1.25 per 100 pounds from New York to Chicago, and proportionate rates to other points. To Chicago, *via* the Boston & Albany Railroad, and thence *via* the New York Central Railroad, only $1 per 100 pounds was charged. To compete successfully for the New England business, the Erie Railway and the Pennsylvania Central Railroad were compelled to carry for the same rates; so that the Boston merchants and manufacturers were really having their goods carried to points in the West more cheaply than the men in this city, whom they could, consequently, undersell. Heretofore the New York Central Railroad officers have allowed the officers of the Boston & Albany Railroad to make the tariff from New England to the West, the former receiving their *pro rata* rate from Albany to all points West. In addition to this there was another influence, although not so formidable as that of the Boston & Albany line. The National Dispatch Company, by reason of contracts with a steamer line, the Vermont Central, the Grand Trunk of Canada, and various Western lines, were enabled to take freight from Boston to Chicago for 80 cents per 100 pounds, and from this city at proportionately low rates. This, however, is a much longer route than either of the others, and Ogdensburg or Montreal are the only points where freight sent by this line can reach the Grand Trunk road.

The merchants of this city have complained that a discrimination was made in favor of Boston, and the agents of the Erie Railway in various New England cities and towns have been writing, at intervals, to the General Agent here that the rates by other lines were lowered at intervals, and asking for instructions. It was evident that something must be done, or the Erie and Pennsylvania roads would lose not alone their New England business, but much of that from this city. G. R. Blanchard and J. H. Rutter, general freight agents of the Erie and New York Central & Hudson River roads, went to Boston a few days ago and held a conference with Mr. Bliss, General Manager of the Boston & Albany road, but without result. Mr. Bliss professed to be satisfied with the condition of affairs, and was unwilling to make any change. Messrs. Blanchard and Rutter returned to this city, and the Erie managers at once announced their determination to lower their rates so as to compete with the Boston & Albany road, although that would entail an average reduction of 16 per cent. A corresponding reduction by the Pennsylvania Central and New York Central then became necessary, and this precipitated a settlement of the difficulties. Commodore Vanderbilt, or his son, William H., General Manager of the New York Central, it is understood, informed Mr. Bliss that the *pro rata* rate would no longer be continued. Mr. Bliss came to this city, and a long conference was held between the railroad agents, the end of which was in an agreement that the rate from Boston shall be raised to correspond with that from this city to all points East and West. Furthermore, the managers of the Michigan Central and Grand Trunk lines have agreed to do away with the *pro rata* arrangement existing with the National Dispatch line, and to charge proportionately the same rates as the trunk lines and their connections.

By this arrangement, if the present low rates are continued by the National Dispatch line, this company and the Vermont Central will have to bear the burden alone. The new arrangement goes into effect at once. It has also been determined that the agreement made in December last, and signed by the agents of the various lines, shall be enforced rigidly. The provisions of this agreement are as follows:

"It is agreed that the trunk lines and their several fast freight, dispatch, transportation and colored lines will not hereafter make any contracts westward, in any form whatever, with forwarders or receivers, at less than the joint tariffs, unless by agreement of the general freight agents of the trunk lines; nor guarantee the continuance of such rates more than one week from the time such rates are given, unless they are agreed upon to continue for a fixed period; nor guarantee time under any circumstances. It is also agreed by the several connections of the trunk lines, that they will not, under any circumstances nor in any forms, abate, directly or indirectly, their respective proportions of the through westward rates fixed by the trunk lines; nor pay salaries, expenses or commissions, in whole or in part, to agents or clerks of freight associations or other shippers; nor give passes to forwarders or receivers of freight; but will leave through rates, classifications and conditions westward solely in the hands of the trunk line officers, without any forms of concession, interference or complications whatever on their respective lines. The purpose of this agreement is declared to be the maintenance of absolute uniform rates and classi cations by all lines, routes and transportation companies; and we pledge ourselves to discontinue every form of direct, indirect or remote detail which, in the exercise of the strictest good faith, can be construed as an unfair inducement to secure trade against honorable competition."

It is believed by the general freight agents of the various lines that this action insures a uniform freight tariff from this city to all points East and West, more particularly the latter, until the opening of navigation, when the spring schedule of rates is adopted. The Baltimore & Ohio Railroad is not a party to the agreement. Nevertheless, this road to reach Philadelphia is compelled to use the Camden & Amboy Railroad, which is under the control of the Pennsylvania Company, whose officers can charge the Baltimore & Ohio whatever rate they please. Hence the latter road is removed from active competition. By the restored schedule the rates to various points are as before, without rebate or drawback of any kind.—*New York Tribune, Feb.* 14.

OLD AND NEW ROADS.

Dividends.

The Chicago & Alton pays a half-yearly dividend of 5 per cent. at the office of M. K. Jesup & Co., No. 59 Liberty street, New York, March 6.

Geneva & Ithaca.

The New York *Tribune* of the 15th says:

"C. M. Titus purchased yesterday in this city 1,200 tons of rails with which to begin laying the track of the Geneva & Ithaca Railroad, which he says will be completed by July 1. The road is 40 miles in length, and will connect at Geneva with the Sodus Point Railroad, and thence with Canada. In anticipation of the completion of the road a 40-ton blast furnace is in process of erection by Ezra Cornell, John McGraw, Henry W. Sage, C. M. Titus, and others, for smelting ores from Canada and Western New York."

The New Jersey Central and Delaware, Lackawanna & Western Agreement.

The New Jersey Legislature has passed an act concerning this agreement (made March 16, 1872) which, the Newark *Advertiser* says, "confirms and explicitly declares it to be 'a valid agreement, any law to the contrary notwithstanding, and the parties to the agreement may exercise all the powers necessary to give effect to the purposes, objects and intention thereof.' The act passed without active opposition, and it may be inferred that the provisions of the consolidation will be perfected as originally contemplated, unless other legal difficulties not now apparent shall arise."

The first section of the agreement is:

"First, That from and after the date hereof, the entire railroads, properties and interests now held by said companies, whether as owners, lessees or otherwise; and also all railroads, properties and interests hereafter by either or both of said companies built or acquired, shall be forever operated and managed as a joint estate, and under the joint management hereinafter provided for; and that upon the capital stock of the said companies, which has been and which may hereafter be issued, equal dividends shall be forever paid; and the entire receipts of every kind and description whatsoever of both of the said companies, including all moneys which may be received for new stock and bonds issued, or for assets or other property disposed of, shall be deemed and regarded as joint receipts; and the entire expenses of both of the said companies shall be deemed and regarded as joint expenses; and that out of the said joint receipts the said joint expenses and all the other debts and liabilities of both of the said companies shall, as and when they become due, be paid; and the surplus shall be disposed of in such manner as shall be jointly directed; and if at any time the joint receipts be insufficient to pay the joint expenses and other matured debts and liabilities, the deficit shall be jointly provided for."

Just how the New Jersey or any other Legislature can establish a binding contract when none has been made, does not appear. Laws, to have any effect, usually must precede and not follow the acts which they concern.

St. Joseph & Denver City.

Nemaha County, Kansas, authorized its Commissioners to subscribe $125,000 in its bonds to the stock of the Northern Kansas Railroad Company, afterwards consolidated with the above company. The bonds not being delivered to the St. Joseph & Denver Company, it brought suit in the Supreme Court of Kansas for a mandamus to compel their issue. This suit the Court has recently decided against the company, on grounds expressed in the following syllabus of the decision filed February 6, 1873:

"Where, after an election had been held in a county, which resulted in authorizing the Commissioners to subscribe to the stock of a railroad corporation, and before such subscription had actually been made, such corporation, in pursuance of authority granted by general law in force at the time of the election, consolidated with another railroad corporation, held that the authority to make any subscription was terminated, and that an attempted subscription by the Commissioners to the stock of the new and consolidated corporation, was *ultra vires*, and did not bind the county."

Great Western of Canada.

This company invites proposals for supplying it with 100,000 soft-wood ties (red oak, tamarac, rock elm or other suitable wood), not less than eight feet long, 90 per cent. with nine inches and the rest with twelve inches face, and six inches thick, to be delivered by the 1st of October. Proposals are to be in as early as the 22d inst.

The company also invites tenders for a great quantity of old material, including 250 tons of wrought scrap iron, 5 tons of boiler-plate cuttings, 60 tons thin sheet iron, 15 tons cast iron, besides 50 tons cast car wheels, 14 tons spring steel, 2½ tons iron crank axles, 35 tons car axles, 3 tons old brass flues, two tons old india-rubber springs, etc. Proposals for these will be received until the 25th inst.

Southern Minnesota.

The La Crosse (Wis.) *Republican and Leader*, of February 15, says: "The Southern Minnesota Railroad Company have resolved to build the railroad bridge across the Mississippi River, at the point in this city located by the Government Engineers, and the work of construction has already begun.

"The Congressional Committee, to whom the La Crosse Railroad Bridge matter was referred, have, we are informed, reported favorably to the Government location, and upon this assurance that Congress will stand by the decisions of its engineers, the Southern Minnesota Company have begun the work promptly."

The Southern Minnesota road having been lately put in the hands of a receiver on account of non-payment of the interest on its bonds, and the company having been reported as unable to pay its employees, it does not seem very probable that it would be able to undertake so expensive a work as the construction of a bridge over the Mississippi.

Pennsylvania.

A resolution passed the Pennsylvania Senate, February 17, requesting the Governor to return the bill recently passed by the Legislature authorizing the Pennsylvania Railroad Company to increase its capital stock and issue bonds. It is said that the bill is recalled by its friends in order to insert a provision limiting the increase of stock and bonds.

New York & Harlem.

The contract for the "Fourth avenue improvement," between Forty-ninth street and Seventy-ninth, including a large amount of tunneling, has been let to Dillon, Clyde & Co., and signed, sealed and delivered.

Missouri Kansas & Texas.

The Galveston (Tex.) *News*, of February 9, says:

"From our exchanges we learn that the report that an attempt would be made to confer the charter privileges held by the Trans-Continental upon the Missouri, Kansas & Texas road, from Sherman to Denton, and to allow the Trans-Continental to deflect northward, is officially contradicted."

Hamilton & Lake Erie.

The rails are laid on this road from Hamilton, Ontario, to Caledonia, 11 miles. At this point connection is made with the Buffalo line of the Grand Trunk Railway. Work on the next section from Caledonia to Jarvis, 17 miles, is being pushed rapidly forward. At Jarvis the line will connect with the Air Line of the Great Western, and at Hagarsville with the Canada Southern.

Sharon & Greenfield.

The directors of this company have resolved to change the gauge of the road from 3 feet to 4 feet 8½ inches. The road is to extend from Sharon, Pa., on the Erie & Pittsburgh road, east 10 miles to Greenville.

Buffalo & Jamestown.

The contractors have completed the grading for 20 miles from the starting point at Buffalo, and the track is laid for 12 miles. Work has been commenced on the south side of Cattaraugus Creek, at Gowanda. The bridge over the creek at that place will, it is estimated, cost $93,000.

Chicago & Michigan Lake Shore.

Grading on the Muskegon & Big Rapids Branch is completed, and tracklaying is rapidly progressing, the track having reached a point 12 miles from Big Rapids.

Marquette & Mackinac.

An effort is being made to secure a grant of swamp lands from the State of Michigan in aid of the construction of this road.

Cleveland, Columbus, Cincinnati & Indianapolis.

The annual meeting of this company will be held in Cleveland, O., March 5.

Rhinebeck & Connecticut.

Work on this road, which is to extend from Rhinecliff, N. Y., on the Hudson River, northeast to Boston Corners, on the New York & Harlem road, a distance of about 27 miles, is progressing well, and it is hoped that tracklaying will be commenced by June 1.

Railroad Taxes in Indiana.

A law recently passed by the Legislature of Indiana provides that no tax shall be levied for the purpose of taking of stock or making donations to railroad companies until the road shall have been permanently located in the county or township making the donation. In cases where the amount may have been placed on the tax duplicate, the taxes may be carried forward, but not charged until such railroad company shall not only have permanently located the road, but shall have expended in the actual construction of the road a sum of money equal to the amount donated by the township or county. When this is done, the tax shall be collected at once. If no work is done within three years, the County Commissioners may annul the subscription on application of 25 freeholders, provided 30 days' public notice is given of such application.

The law is intended to put an end to the raising of money by taxation or sale of county stock to pay salaries to officers of projected railroads.

Virginia Mining, Manufacturing & Transportation Company.

This company has asked the Virginia Legislature for authority to build a railroad from Winchester, Va., southeast to some point on the Potomac between Alexandria and Acquia Creek. The road is to be chiefly for the transportation of iron ore and other minerals.

Elkton & Oxford.

This company, recently organized in Maryland, proposes to build a railroad from Middletown, Del., on the Delaware Railroad 25 miles from Wilmington, northwest through Elkton, Md., to Oxford, Pa., a distance of about 35 miles. The capital stock is to be $250,000.

[Continued on page 77.]

* For the New York Central, these losses amounted to 11½ cents per share, which is nearly 1½ per cent. of the dividend; for the Erie they were about 8¼ cents per share—and just so much more than the dividend.—EDITOR RAILROAD GAZETTE.

RAILROAD GAZETTE

Published Every Saturday.
A. N. KELLOGG & CO., *Proprietors.*
S. WRIGHT DUNNING AND M. N. FORNEY, *Editors.*

CONTENTS.

	Page		Page
ILLUSTRATIONS:		GENERAL RAILROAD NEWS:	
Modulating Steam Whistle..	71	Old and New Roads	73, 77
Improved Compound Rail...	71	Traffic and Earnings.....	76
Registering Steam-Gauge...	71	Elections and Appointments	76
Locating Frogs...	71	Personal.....	77
CONTRIBUTIONS:		Scrap Heap.....	77
Locating Frogs.....	71	MISCELLANEOUS:	
Timber Work on Railroads..	71	"Modulating" Steam Whistle.....	71
Track-Laying and Ballasting	72	Improved Compound Rail...	71
Power Brakes in Congress..	72	Holt's Registering Steam-Gauge	71
EDITORIALS:		Important Freight Agreement.....	73
The Narrow Gauge Controversy.....	74	Report of the New York Central & Hudson River Railroad.....	76
Congress and Railroad Improvements.....	75	Locomotive Returns for September, 1872.....	77
Growth of Traffic and Earnings on the New York Central & Hudson River Railroad	75		
Editorial Paragraphs	76		

Editorial Announcements.

Correspondence.—*We cordially invite the co-operation of the railroad public in affording us the material for a thorough and worthy railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.*

Inventions.—*No charge is made for publishing descriptions of what we consider important and interesting improvements in railroad machinery, rolling stock, etc.; but when engravings are necessary the inventor must supply them.*

Articles.—*We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay.* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

THE NARROW-GAUGE CONTROVERSY.

We have before us an accumulation of literature* relating to this subject, which has been steadily growing for some months past, and which indicates that considerable attention is still given to it, and that much difference of opinion exists in relation to the merits of this system.

Attention has been drawn to it, because, the world over, a want is felt for cheaper methods of transportation, especially in sections of country where comparatively little traffic exists; and the available capital which can be employed in the construction of railroads, as usual, bears a tolerably exact proportion to the business transacted. It is therefore not at all surprising that the claims which the advocates of the narrow-gauge system make, and the statements which they have scattered so widely and presented with so much ingenuity should arrest attention and obtain credence among those who are unaccustomed to make estimates of engineering work, or ignorant of the construction of railroads. What is more surprising, however, is to find that engineers eminent for their knowledge and experience should occupy opposite sides of this question, and should contend so vehemently for the accuracy of their views, although they often seem to be diametrically opposed to each other, and almost absolutely contradictory. We are, of course, leaving out of consideration altogether the immense class of adventurers who are always so ready to grind their own axes on any stone which the public is willing to turn, and who have found the narrow gauge and the interest taken in it so "sweet a boon." What we purpose to deal with now is the apparently honest opinions and arguments of those who advocate and those who oppose the narrow-gauge system for building railroads, and to review the discussion which has now been carried on so long, and whose literature has become so formidable, and much of it also exceedingly tedious and stupid. It is, of course, quite impossible, in the time and space at our disposal, to give anything like an analytical review of the discussion of the subject, or of the dissertations before us. These latter present quite a curious medley, coming as they do from almost all quarters of the globe. Among them is Mr. Fairlie's "Battle of the Gauges Renewed," which is an answer to Mr. Seymour's pamphlet in reply to a report prepared by General G. P. Buell, formerly Chief Engineer of the Texas Pacific Railroad. It is intended as an exhaustive reply to Mr. Seymour, and discusses his pamphlet paragraph by paragraph. Mr. Latrobe's letter, part of which is reprinted on another page, was written to and published by Mr. W. W. Evans, of New York, who has heretofore taken quite an active part in the discussion of this question. Coming as this does from one of the oldest, most experienced and eminent engineers in this country, it will probably have more influence than anything else thus far published relating to this subject. We have also two editorials in *Engineering*, one of them criticizing severely Mr. J. P. Kennedy's report upon railway gauges in India which he addressed to the directors of the Bombay, Baroda & Central India Railway Company. As our readers know we and our much-valued contemporary have occupied opposite sides in the discussion of this subject. Nevertheless, and making due allowance for our difference of opinion, we were surprised at the objection made by the writer in *Engineering* to accepting the judgment of the Institution of Civil Engineers upon the merits of the narrow gauges, the verdict to be rendered after a searching analysis and full discussion.

The report of Mr. Carl Pihl to the Victorian Government advocates light railroads very strongly, but is rather conservative regarding the advantages due to the gauge alone. "The Narrow Gauge" is an article written for and published in the Chicago *Inter-Ocean*, and has a sort of "reportorial" odor about it which is unpromising of scientific accuracy. It contains, however, some data concerning cars built for the Cairo & St. Louis Railroad which are useful for comparison. "The Railway Question," by J. de J. Cuevas, is from a Mexican paper, and was evidently intended for a campaign document during the recent session of the Mexican Congress, and is very amusing. "The Narrow Gauge in New Zealand" is a criticism from the *Railway News* of Mr. Kennedy's report.

Any one who will read these discussions, and who studies the question in other directions, will find, we think, that as the question now stands the advantages which are claimed for the narrow-gauge system are as follows:

1. A reduction in cost, owing to the narrower gauge requiring less width of roadway in embankments and cuts.

To this the answer is, that (*a*) the saving in cost *which is due to the distance between the rails* will amount to a very small percentage of the cost of graduation; (*b*) that there will be no saving at all in cuttings or tunnels, if cars of the same width are used on both gauges, as is quite practicable; (*c*) and that the bearing surface, and consequently the length of the cross-ties, is governed by the weight and not the gauge of the cars, and, therefore, if the latter are made as light for the one gauge as for the other, the ties may be of the same length, and the embankments of the same width in both cases. (*d*) Mr. Fairlie says in his book that "*An average mile of properly designed narrow-gauge road, ready for grading, is not an average mile of standard road with a piece cut out of the center.*" Now if a standard-gauge road, "with a piece cut out of the center" is not a narrow-gauge road, what is it? Whether it is "properly designed" is quite another question; nor does it appear why it is impossible to "properly design" a wide-gauge road as well as one which is narrow.

2. It is said that the difference in the length of the inside and the outside rails is greater on wide than on narrow-gauge roads, and that therefore the slipping of the wheels in passing around curves is less on the one than on the other, and that therefore the resistance of cars is less, and consequently that shorter curves are practicable. From this follows the inference, that as shorter curves can be used, therefore the road can conform more to the inequalities of the country in which it is built, and the cost of graduation thus be diminished.

These premises and conclusions are denied, for the following reasons: (*a*) The degree of curvature is not determined by the resistance of cars, but by their stability and ability to remain on the rails. (*b*) Wide-gauge cars having more stability, other things being equal, than those for a narrow gauge, can run around curves of as short radii as the latter. (*c*) The amount of the difference in resistance is purely surmise, as none of the statements which have been published are based upon actual experiments. (*d*) Calculating from purely theoretical data, it is evident that the resistance on curves is influenced only to a very slight extent by the gauge. (*e*) With a single exception, shorter curves are now operated on lines of the standard gauge in this country than on the new narrow-gauge roads.

3. It is asserted that cars of a given capacity for narrow-gauge roads are lighter than those for the standard gauge, and that, their gross weight being less, lighter engines are needed to draw the trains and lighter rails to carry them and less bearing surface for the cross-ties on the road-bed, and that consequently shorter ties can be used, and narrower embankments will be required.

The reply made to this is (*a*) that the weight of the car-body, wheels, axle-boxes, jaws and longitudinal framing of the trucks and brake attachments, excepting the brake beams, are not affected by the gauge, and that the difference in the weight of the axles, transverse framing of the trucks and brake beams for a 4 ft. 8½ in. and a 3-feet gauge is only about 4½ per cent. of the weight of an eight-wheeled box car empty, and a little more than 2 per cent. of it loaded. The weight of empty four-wheeled cars for the standard gauge will be only about 2 per cent. more than for a 3-foot road, and about 1 per cent. when loaded. (*b*). Some of the cars in this country on standard-gauge roads weigh very little, if any, more in proportion to their capacity (estimating the latter by the cubical contents for freight and seating capacity for passengers) than the cars for similar traffic on narrow-gauge roads. Thus, eight-wheeled freight box cars for the Denver & Rio Grande 3 feet gauge railway, with 680 cubic feet of capacity, which if rated at 15 lbs. per foot, would give a load of 10,200 lbs., weigh 8,800 lbs., or a proportion of 1 to 1.16. The cars for the Cairo & St. Louis road weigh 10,000 lbs. and have a capacity of about 800 cubic feet, or 12,000 lbs., or a proportion of 1 to 1.2. Mr. Smith's new box cars on the Erie 6-foot gauge have a proportion of 1 to 1.17. The passenger cars on the Denver & Rio Grande road weigh 416 lbs. per passenger, and those for the Cairo & St. Louis 469 lbs. per passenger. On the New Jersey (4 ft. 10 in. gauge) road are cars which, with the same seating room as that given in the narrow-gauge cars, would weigh 435 lbs. per passenger; on the Erie (6 feet gauge) only 385; on the New York Elevated road (4 ft. 10 in. gauge) 259 lbs. per passenger; and four-wheeled horse cars which weigh 4,400 lbs. have 22 seats, and therefore weigh just 200 lbs. per passenger. The same cars, as we know to our sorrow, in New York *very* often carry 50 or more passengers. (*c*) "The capacity of cars for either passengers or freight depends upon the area of their floor, and the nearer a parallelogram approaches to the square in the length of its sides, the more space will it inclose with a given outline." Therefore the proportion of the weight of the sides of a car to the area inclosed is reduced if the width is increased—an advantage which a wide gauge has over a narrow.

4. It is claimed that for a light traffic, small cars are much more economical than large ones, and that, while it is possible to make the latter for a wide gauge with as small a proportion of dead weight to carrying capacity as for a narrow gauge, *small* cars for the latter will weigh materially less than they will for the standard gauge.

This argument has been answered, (*a*) by the fact, that the size of cars, and consequently the gauge, has been determined by the stature of ordinary men and women and the requirements of their industry, and that the weight of cars to fullfil these requirements is not materially affected by the difference in distance between the rails of the proposed narrow gauges and the present standard width of 4ft. 8½in., as has been shown. (*b*) That the economy imputed to the use of *small* cars is dependent more upon the traffic management and the skill with which freight and passengers are received on the cars, and the latter distributed to meet the wants of the business of the line.

Many arguments besides those which we have presented in favor of narrow-gauge roads are current in the newspapers, and among those who advocate or are interested in the construction of such roads. Many of these are too absurd to need refutation. As we have frequently taken occasion to point out, nearly all the narrow-gauge reasoning rests on the assumption that the cars weigh less *because* the rails are near together. To inexperienced people, this looks so plausible that they accept it at once, and then build their elaborate structure, which is always surmounted with a gilded sum total of dividends and profits. What is quite curious, however, is that in nearly all the dissertations before us, the authors renounce the idea that the economy of the narrow-gauge "system" is due to the gauge. Mr. Carl Pihl, the Engineer of the Norweigan narrow-gauge railroads, says:

"With reference to the 'gauge,' I am sorry to say that it has been but too often, and I have no doubt sincerely, represented that the cost of a railway depends on and is in proportion to the width of gauge; such a fallacy I need scarcely do more than allude to. The gauge alone cannot of course make a cheap railway; I rather consider it as the basis upon which to operate, to combine the proper proportions of parts with

* 1. The Battle of the Gauges Renewed, by Robert F. Fairlie.
2. A Letter on the Railway-Gauge Question, by Benjamin H. Latrobe. C. E.
3. The Soudan Railway; *Engineering*, Jan. 24, 1873.
4. Narrow-gauge Railways; *Engineering*, Jan. 31, 1873
5. Narrow-Gauge Railways; Lieutenant-Colonel J. P. Kennedy.
6. Mr. John Fowler's Report on the Soudan Railway.
7. Mr. Carl Pihl's Report to the Government of Victoria on the Norwegian Railways.
8. Narrow Gauge; *The Inter-Ocean*, Jan. 11, 1873.
9. The Narrow Gauge in New Zealand and India; *Railway News.*
10. Circular of the Committee of the Master Mechanics' Association appointed to report on "The Relative Cost of Operating Roads of Gauges of 3ft. 6in. and Less, and Those of the Ordinary 4ft. 8½in. Gauge."
11. The Railway Question, by J. De J. Cuevas, [translated from the *Voz de Mexico*, Nov. 15, 1872].

economy in order to get a harmonious whole in the construction. Of course there is nothing to hinder the application on a broad gauge of some of those principles belonging to the now called 'light system of railways,' such as lighter rails, smaller and lighter engines, &c.; but this can only, in my opinion, be justified by special circumstances. Economy in first outlay and in working afterwards can only be properly and fully obtained in all parts by bringing the whole construction into proper harmony and proportion. To use a light railway on a broad gauge would be generally inconsistent with sound economy."

He is silent, however, regarding the reasons why the "proper harmony and proportion" is impossible on 4 ft. 8½ in. gauge, or why the latter "would generally be inconsistent with sound economy." With reference to the cars, he says:

"As regards the dead weight of all the Norwegian narrow-gauge rolling-stock in proportion to its carrying capacity, it will appear from the inclosed table that it compares very advantageously with that of the ordinary 4 ft. 8½ in. lines. This is not owing, as many advocates of the narrow-gauge system contend, to the gauge only, but to this in connection with the peculiar manner in which the rolling stock is, on the whole, constructed, and especially to the arrangement of the draw and buffer bars."

We are quite unable to know why the "peculiar manner" of construction, or "the arrangement of the draw and buffer bars," is not applicable to wide-gauge cars. The advocates of the narrow-gauge system seem to be playing Hamlet with the character of Hamlet left out. They say a narrow-gauge road has grea advantages over the standard gauge, but when questioned closely they reply that it is not in the gauge that the advantage is to be found, but in something else. It would, we think, be interesting to have them reply to the circular of inquiry issued by the Committee appointed by the the Master Mechanics' Association to report on "The Relative Cost of Operating Roads of Gauges of 3 ft. 6 in. or Less and Those of the Ordinary 4 ft. 8½ in. Gauge." The Committee solicit replies to their circular or any additional information relative to the subject. The questions are as follows:

1. Have you had any experience in operating railroads of gauges narrower than 4 feet 8½ inches?
2. If so, have you observed any material difference in the cost of transporting any given amount of freight or number of passengers, as compared with the cost of doing an equal amount of business on a road of the standard 4 feet 8½ inch gauge?
3. If you can do so, furnish the committee with statistics, regarding the *relative* cost of transportation on the roads of different gauges, or your reasons for thinking there is or is not a difference.
4. In your opinion, would *small* cars, say of half the capacity of those ordinarily used, be more economical than the latter, for a road with comparatively little traffic?
5. What do you think the difference in weight *which is due to the distance between the rails* would be between such cars of equal strength for a 3-feet gauge, and for one of 4 feet 8½ inches? And to what causes is the difference attributable?
6. What would be the difference in the percentage of cost of such cars?
7. It is also said that narrow (3 feet) gauge cars offer less resistance in passing around curves than wide (4 feet 8½ inches) gauge cars of *the same character and weight*. In your opinion, is there any material difference in the power required to draw such cars around curves of say 400 feet radius, and are your conclusions based upon practical experiment or theoretical considerations?
8. Do you think that for a section of country with a small traffic a light narrow-gauge road would be more economical to operate than an equally light road and equipment of the standard (4 feet 8½ inch) gauge; and if either road would have any advantage over the other, what are they?

J. T. ROBINETTE, Atlantic, Mississippi & Ohio Railroad, South Side Division,
J. U. EASTMAN, Nashville & Chattanooga Railroad,
W. BELL SMITH, South Carolina Railroad,
} *Committee.*

Replies to this circular are to be addressed to J. T. Robinette, Petersburg, Virginia.

No doubt the Committee would be glad to receive information from any source in relation to this subject, and we trust, therefore, that the managers of narrow-gauge lines in Europe and elsewhere will communicate with them.

So much has been said and written about the Festiniog Railway that we refer to it with reluctance; but so many arguments have been based on it as a text, that the opinion of a skillful engineer who carefully examined its operation and construction may, perhaps, at least modify the effect of some of the rose-colored accounts of it which have been disseminated so widely. With the letter of Mr. Latrobe, Mr. Evans has printed one from Mr. Guilford L. Molesworth, Director of Public Works, Ceylon who visited this now celebrated road. We regret that we have not space to print it entire. After stating that "the charge on this road for carrying slate is 2½d. per ton per mile, and 2½d. for other traffic, which may be said to be almost entirely mineral, being of coal and lime," he says: "Now the mineral rates charged on ordinary English lines vary from ¾ to 1d. per ton per mile, *or less than half the rates charged* on the Festiniog Railway. * * * Suppose that the Festiniog Company were forced by competition, or otherwise, to carry their traffic at the same rates as those adopted on other lines, the receipts would at once be reduced to one-half, or, instead of £23,676, they would only amount to £11,838, while the working expenses, still remaining unaltered, would be £13,050, or a deficit of 12½ per cent."

Mr. Molesworth sums up his report on this road as follows:

"1. The proportion of working expenses to receipts would be greater than that of the average English lines were the rates of freight the same.

"2. The interest of 29½ per cent. would dwindle down to a deficit, were the ordinary mineral rate charged.

"3. The advantages of dead load do not hold good in the case of lighter and more bulky freights than slate.

"4. The dead load of the passenger traffic is due to the *traffic arrangements*, rather than to any specialty of construction.

"5. The sharp curves which are claimed as the principal cause in the saving of construction are not peculiar to the Festiniog gauge.

"6. Light engines and rolling-stock may be employed without having recourse to the exceptionally narrow gauge.

That the enthusiasm for narrow-gauge railroads is diminishing in this country, there can be no doubt; and we can confirm what Mr. Evans reports in his pamphlet—that there is now but little inquiry and fewer orders for narrow-gauge engines.

Thus far the narrow-gauge roads which have been actually built in this country are as follows:

Name.	Gauge, feet.	Miles.
Denver & Rio Grande	3	156
Arkansas Central	3	48
Iowa Eastern	3	20
Utah Northern	3	33
Cairo & St. Louis	3	27
Central Valley	3	12
American Fork (Utah)	3	18
Painesville & Youngstown	3	12
North & South of Georgia	3	20
Kansas Central	3	56
Colorado Central	3	24
Tuskegee	3	5½
Louisville, Harrod's Creek & Westport	3	5
Ripley	3	25½
Montrose	3	22½
Total		484½

There is also a very short road of 3-feet gauge at Akron, O.; a city passenger road of the same gauge in St. Louis, and one in Cincinnati, and some of the roads named may have been extended since our last information.

Like the horse epidemic, the narrow-gauge enthusiasm has nearly expended itself, we believe, and, as Mr. Seymour in his letter in Mr. Evans' pamphlet says, the only thing which now remains to be done is to allow it to do as little injury as possible, which has been the object we have had in view in writing this article.

CONGRESS AND RAILROAD IMPROVEMENTS.

A correspondent, whose letter is published elsewhere, sends us a copy of a bill recently introduced into Congress providing for two radically different objects: one the compulsory adoption of power brakes, worked from the engine, by all railroads carrying passengers, and the other the reporting of all railroad accidents to the national government. As regards the last of these, we have no question as to its desirability. It is required now in several of the States, and there probably will be many who will contend that legislation by Congress on this subject would be an interference with the rights of the States. This is a question, however, which courts and not the RAILROAD GAZETTE can decide. The same doubt, of course, applies to legislation concerning brakes on trains whose trips do not cross the border of any State; but besides the question of constitutionality and the legal authority of Congress to legislate on such a matter, there is a question concerning its advisability, which we may properly consider.

First, generally, when the law gives one or several men a monopoly of an invention or class of inventions by a patent, and then requires absolutely that this invention or class of inventions shall be used, it is evident that the users are placed wholly at the mercy of the patentees. They must use the invention, and the patentees may ask whatever they please for it. It is only when the patentees of this class of inventions are very numerous that the monopoly ceases. Twenty, thirty or forty could combine, and would be very likely to, if they were sure of their customers at their own prices. Ordinarily the patentee's price is limited by the demand for his patent, and this demand is somewhat in proportion to the value of his invention and the necessity for it. If it is the only one of its kind, the customer may refuse to use it at all if he thinks that the cost is greater than the advantage to be derived from it.

But a greater objection, perhaps, is the lack of qualifications in Congress for judging of the value or necessity of improvements, and the great opportunities for jobbery and corruption which such a policy would afford. Power brakes (some of them) are excellent things, and railroad companies are justified in adopting them at considerable expense—are, perhaps, not justified in declining to adopt them. But having enforced the adoption of this improvement by act of Congress, we may be sure that other owners of patents who have or who can command "influence," or exercise a "pressure" on Congressmen, will be quick to see their opportunities, and their success in improving these opportunities will doubtless be greater than in improving railroad machinery. It will be easy enough to make a general law which will exclude all but the one patent, or the two or three intended to be benefited. We have visions of the proprietor of the "patent, adjustable, rotary self-coupler," with an act of Congress not indeed requiring the use of the "patent rotary" alone, but forbidding the use of any other than a coupler with certain features which only the "patent rotary" possesses. That patent would doubless be worth a mint of money, should the law be held valid; and the owner thereof could well afford to admit several Congressmen into his Patent Rotary Coupler Company, "on the ground floor," in order to give them the best opportunities for understanding the great merit of that invention and the necessity of protecting the lives and limbs of their constituents by a law compelling all the railroad companies to use this coupler on all their cars. There are a great many improvements whose universal adoption can be very plausibly and perhaps justly urged, and each one of these could easily be made the basis of a gigantic job; and, Congress being utterly unqualified to discriminate between them, it would be quite as likely to legislate in favor of useless or positively injurious devices as of good ones.

If the policy is to be adopted, however, we have a little scheme of our own, the adoption of which we insist upon before anything else of the kind can receive our support. It is well known, or ought to be, that most accidents are the result of the lack of knowledge on the part of railroad officers and employees. If the car-builder had known that such a form and size of axle was too weak, he would have made it stronger; had the track-master known that such a neglect of a joint or tie would have caused a rail to break, he would have put it in order; had the engineman known what he ought to have done, he would not have neglected it and permitted the boiler to explode. Intelligence and alertness in officers and employees are the grand remedy for accidents. Let Congress pass a law to secure these desirable qualifications by compelling all railroad companies to supply all their officers and employees with the RAILROAD GAZETTE (or if this may be thought too special legislation, we will compromise by substituting for our cherished name "a capable weekly railroad journal of not less than twenty-four quarto pages:" that will suit us quite as well). When we have carried through our little job, perhaps we will be better able to see merit in others; and, perhaps (we whisper it), we might join forces with a coupler and a gauge and a valve and a compound rail and make one great job of it. Consolidated as the "American Anti-Railroad Accident Company," we might "place our stock where it would do the most good," admit Congressmen who have no tender regard for the lives and limbs of travelers "on the ground floor," and thus become the humble instruments of incalculable good to the human family—at least to those members of it who may be also members of the "American Anti-Railroad Accident Company."

Growth of Traffic and Earnings on the New York Central & Hudson River Railroad.

We give this week the annual report of this company for the last fiscal year (ending September 30, 1872,) with some comparisons with the preceding report. This is one of the three chief highways for traffic between the East and the West, doubtless by far the leading one between New England and the West, and its reports therefore always have an interest which extends to a very large portion of the community. Its business also is done on a large scale, and it is one of the few examples in this country from which we may learn the results of carrying a very large traffic on one line. As it is by this concentration of traffic on single lines that we must look for any large reduction in the cost and price of transportation, we will do well to consider what the experience of this road has been for an extended period.

The following is a table of the earnings for ten years:

Year.	Passengers.	Freight.	Other.	Total.	Net earnings.
1862-3	4,484,817	9,449,554	547,162	14,479 533	5 8 8,475
1863-4	5 845 116	10,685,072	561,702	17,130,489	5,094,039
1864-5	6,621,406	11,000,058	8 6.441	18,427,905	3 689 382
1865-6	6,498,193	12,017,534	925,587	19,442,3 2	4,350,421
1866-7	6,057,824	11,993 0 8	1 195,782	19 246,614	4,332 405
1867-8	6,064,266	12,479 950	1,361,6 9	19,904 915	6,3 0,069
1868-9	6,498,408	14,066,386	1,506,2 0	22 071,074	7,9 4 512
1869-70	6,738,592	14,489,217	1,135,511	22,363,320	8 295,240
1870-1	6,224,740	14,647,580	1 099,786	21,972,105	8 260,817
1871-2	6,662,007	16,259,647	2,659,022	25,580,676	9,134,239

This shows the progress of the business of the road very clearly. It is noticeable that there has been no considerable increase in passenger earnings since 1864-65, the average for the past eight years having been about $6,420,000, which average was exceeded in 1864-65, 1865-66, 1868-69, 1869-70, and 1871-72. In freight earnings, on the contrary, the increase has been rapid and almost interrupted for the ten years, there having been in only one year (1866-67) a falling off, and that very small ($24,500, or ½ of 1 per cent.) The freight earnings of the last year were more than 72 per cent. greater than those of the first year of the decade. The gross receipts have increased even more rapidly, having been nearly 77 per cent. The enormous increase in "miscellaneous" receipts (nearly 400 per cent.) has thus more

than made up for the failure of passenger earnings to keep pace with freight earnings. As these miscellaneous earnings are made for the most part by passenger trains, the improvement in earnings has probably been similar in both services.

A more interesting comparison, and a more encouraging one to both shareholders and the patrons of the company, is given by the table of tonnage mileage for the ten years, and of receipts per ton per mile, which latter we have calculated and added:

Year.	Tons moved one mile.	Receipts per ton per mile.
1862-63	387,387,066	2.44 cents.
1863-64	326,801,761	2.76 "
1864-65	318,732 070	3.45 "
1865-66	388,624,985	3.09 "
1866-67	435,417,629	2.75 "
1867-68	455,046,715	2.74 "
1868-69	589,362 849	2 89 "
1869-70	769,087,777	1.88 "
1870-71	888,327,895	1.65 "
1871-72	1,020,908,885	1.59 "

The great decrease of rates accompanying the great increase of traffic since the war is remarkable. We see that the average receipts per ton per mile were last year very little more than half as much as during the first year after the war. Thus it is seen that the public as well as the shareholders have profited by the prosperity of this company; and great profits divided have not prevented *an average decrease of more than 8 per cent. yearly in freight charges.* A company which can make such progress in reducing its charges for services while increasing its profits must rest on a pretty solid basis. This basis is *a large assured and rapidly growing traffic*, which the position and connections of this road have secured to it.

JANUARY RAILROAD EARNINGS, as our table shows, are unusually light, the obstacles to running trains, such as snow storms and drifts, having been unusually formidable, closing some lines and branches for several days of the month.

THE RAILWAY ASSOCIATION OF AMERICA, we learn, has already secured twenty-three new members since the January meeting, when it became a national association.

Report of the New York Central & Hudson River Railroad.

From the report of this company to the State Engineer and Surveyor, for the year ending September 30, 1872, and comparisons with previous reports, we make the following account of the condition and operations of the road.

	1871.	1872.
Length of road*	740.17	740.17
Second track and sidings	681.92	730.25
Third track	9.50	9.50
Branches owned	298.42	298.42
Second track on do	19.55	19.55
Leased lines	101.46	110.50
Second track on do	....	17.54

* This includes branches.

This is a total of 850.67 miles of line worked by the company, the only change since the previous year being an increase of 6.04 miles in the leased lines. The length of *track* worked was 1,607.96 miles, 128.04 of which was leased. During the year covered by the report, while there was but the trifling increase of six miles in length of line, 48.33 miles was added to the second track and sidings of the lines owned, and 17.54 miles to those of the leased lines.

The equipment with which this road was worked was:

	1871.	1872.
Locomotives	424	447
First-class coaches	333	321
Second-class and emigrant cars	115	70
Baggage, mail and express cars	129	158
Freight cars	8,849	10,983

Here we have an increase of 23 (about 5 per cent.) in the number of locomotives; a decrease of 2 in the coaches (probably owing to an increased use of "palace" cars, not owned by the company); a decrease of 45, or 40 per cent., in the number of second-class and emigrant cars; an increase of 29, or 22½ per cent., in the number of baggage, mail and express cars; and an increase of 2,134, or 24 per cent., in the number of freight cars.

This property is represented by the following capital account:

	1871.	1872.
Capital stock*	$89,428,300 00	$89,428,300 00
Funded debt	15,231,718 93	16,496,020 00
Floating debt	1,167 00	1,167 00
Total	$104,661,185 93	$105,925,487 00

* Including $4,729,000 in consolidation certificates not yet presented for conversion.

The only change in this account is an increase of $1,264,301.07 in the bonded debt. The average rate of interest of this debt is 6½ per cent. This capital account is at the rate of $143,142 per mile of road owned.

The "cost of road and equipment" shows an increase in nearly every item, the largest being $1,327,275 for freight cars. The total cost of road and equipment was:

1871	$60,413,656 37
1872	63,299,921 86
Increase (4¾ per cent.)	$2,886,267 51

Thus the additions to the property of the company, including no new line of road, were equivalent to the cost of a fairly built and equipped line 70 miles long. The present construction and equipment account is at the rate of $85,540 per mile.

The operations of the year are thus reported:

	1871.	1872.
Miles run by passenger trains	3,645,690	4,076,800
" " " freight trains	6,986,107	7,911,257
" " " service trains and in switching		2 699,494
Passengers carried one mile	288,678,896	319,15 ,860
Tons of freight moved one mile	883,327,865	1,020,908,885

This is an increase of about 12 per cent. in passenger train mileage, and of 10¼ per cent. in passenger mileage, the increase in passenger earnings having been about 7 per cent. The increase in freight train mileage is 13¼ per cent., in tonnage mileage 15 per cent. and in freight earnings 11 per cent. The average receipts per ton per mile were 1.59 cents, against 1.65 cents the previous year, the decrease being about 4 per cent.

The earnings of the road were:

	1871.	1872.	Increase.	Per cent. of inc.
Passengers	$6,224,839 74	$6,662,006 82	$437,167 08	7
Freights	14,647,580 66	16,259,646 79	1,612,066 73	11
Miscellaneous	1,099,785 67	2,659,022 26	1,559,236 59	142
Total	$21,972,205 47	$25,580,675 87	$3,608,470 40	16.4

The earnings were at the rate of $26,033 per mile for the first year and $30,071 the second.

The expenses were:

	1871.	1872.
Maintenance of road	$4,564,434 16	$5,153,497 69
Maintenance of rolling stock	3,181,515 08	4,150,599 23
Working expenses	6,245,169 74	7,142,339 40
Total	$13,991,119 98	$16,446,436 32

The increase in expenses is $2,445,326.34, or 17½ per cent., against an increase of 16.4 per cent. in the earnings. The net earnings were thus:

1871, $7,881,095; 1872, $9,134,239; increase, $1,153.144, or 14½ per cent.

This increase in net earnings is sufficient for a dividend of a little more than 1¼ per cent. on the share capital.

The expenses were 63.7 per cent. of the receipts the first-named year, and 64.3 per cent. the last year.

The payments for interest were $1,030,371.63; and for dividends, $7,244,831.78; while the rentals of leased lines amounted to $146,799.30.

Of the tonnage transported in 1871-72, "products of the forest" formed about 7¼ per cent.; animals, vegetable food and other agricultural products, 50 per cent.; manufactures and merchandise, 22 per cent., the remainder being reported as "other articles," which probably includes more coal than anything else, the form for the report strangely omitting minerals.

General Railroad News.

ELECTIONS AND APPOINTMENTS.

—It is reported that Hon. Charles R. Buckalew, late United States Senator and last fall Democratic candidate for Governor of Pennsylvania, has been appointed Attorney of the Lehigh Valley Railroad Company.

—Mr. William H. Perry has been appointed General Freight Agent of the Canada Southern Railroad Company.

—Mr. William Keavy, late General Freight Agent of the Fort Wayne, Jackson & Saginaw Railroad, has received a similar appointment for the Jackson, Lansing & Saginaw Railroad, with headquarters at Saginaw City. Mr. William Donovan, has been appointed Chief Engineer, with full power over tracks, switches and buildings.

—The incorporators of the New Bedford Railroad Company, the new organization of the New Bedford and Taunton Company, have organized by the election of the following board of directors: Joseph Grinnell, of New Bedford; Nathaniel Thayer, of Boston; Samuel H. Howe, of Boston; Lyman Nichols, of Boston; W. J. Rotch, of New Bedford; E. P. Carpenter, of Foxborough; Harrison Bliss, of Worcester; Andrew G. Pierce, of New Bedford; O. A. Washburn, Jr., of Providence; William Mason, of Taunton, Willard Lovering, of Taunton; H. N. Bigelow, of Clinton; George A. Torrey, of Fitchburg; W. W. Crapo, of New Bedford, and George E. Towne, of Boston.

—At the annual meeting of the St. Croix & Penobscot Railroad Company, the following officers were elected: George M. Porter, E. A. Barnard, H. A. Hill, John McAdam and W. W. Sawyer, directors; Samuel Black, Treasurer; and Frank Nelson, Clerk. At a subsequent meeting of the directors, George M. Porter was elected President, W. W. Sawyer, Superintendent, and Samuel Black, Clerk.

—At the annual meeting of the stockholders of the Pennsylvania Transportation Company, held at Titusville, Pa., February 11, the following board of directors was chosen: P. H. Watson, C. B. Wright, William H. Kemble, George K. Anderson, J. Douglass, William H. Abbott, A. R. Williams, I. G. Jackson, Henry Harley. The following were elected officers: Henry Harley, President; Geo. K. Anderson, Vice-President; William H. Abbott, Treasurer; Thomas W. Larsen, Secretary; William Warmcastle, Superintendent.

—Mr. John B. Peters has been appointed Assistant General Supervisor of trains of the Ohio divisions of the Baltimore & Ohio Railroad.

—At the annual meeting of the Fort Wayne, Jackson & Saginaw Railroad Company, at Jackson, Mich., February 11, the following board of directors was chosen: P. B. Loomis, Dwight Merriman, E. A. Webster, D. D. Thompson, W. R. Reynolds, Jackson, Mich.; E. O. Grosvenor, Jonesville, Mich.; A. P. Edgerton, P. P. Rudisell, J. H. Bass, S. C. Evans, Fort Wayne, Ind.; J. F. Joy, Detroit; C. F. Kinney, Angola, Ind.; C. A. McClellan, Waterloo, Ind. The board organized as follows: President, P. B. Loomis; Vice-President, A. P. Edgerton; Secretary, Eugene Pringle; Treasurer, B. S. Chapin; Executive Committee, P. B. Loomis, E. A. Webster, E. O. Grosvenor, A. P. Edgerton and H. P. Rudisell.

—The directors of the Connecticut Central Railroad Company have elected the following officers: President, John W. Phelps, of Springfield; Vice-President, Francis Gowdy, of East Windsor, Conn.; Secretary and Treasurer, J. W. Stoughton, of South Windsor, Conn.

—Hon. Ginery Twichell, of Brookline, Mass., has been chosen President of the Boston, Barre & Gardner Railroad Company. Mr. Twichell is a director of the Boston & Albany Company.

—At the annual meeting of the stockholders of Wells, Fargo & Co., held at San Francisco, Cal., February 5, the following directors were chosen for the ensuing year: Lloyd Tevis, W. G. Fargo, A. H. Barney, B. P. Cheney, D. O. Mills, Leland Stanford, J. B. Haggin, Oliver Eldridge and Mark Hopkins.

—At the annual meeting of the stockholders of the Marietta & Pittsburgh Railroad Company, at Marietta, O., A. J. Warner, W. P. Cutler, T. W. Ewart, Samuel Shipman, of Marietta, O.; W. H. Frazier, Isaac Morton, of Cambridge, O., and Augustus Wilhelmi, of Pittsburgh, Pa., were chosen directors. Mr. Ewart replaces W. P. Richardson, the other members of the board being re-elected.

—The incorporators of the Portland & Bath Railroad Company, recently chartered by the Maine Legislature, met at Bath, Me., February 12, and organized the company by electing the following directors: Charles Levi Woodbury, D. Lovering, jr., E. L. Giddings, T. H. Hubbard, Arthur Sewall, C. W. Larrabee, Franklin Reed and A. R. Reed. Subsequently the directors met and organized by the choice of Charles Levi Woodbury for President. C. E. Fuller was elected Treasurer, and E. Page, Clerk.

—At the annual meeting of the Philadelphia & Erie Railroad Company, at Philadelphia, February 10, Edward F. Gay, J. Edgar Thomson, Wistar Morris, Joseph W. Gaskill, Jacob P. Jones, Josiah Bacon, Samuel T. Bodine, John M. Kennedy, A. J. Derbyshire, Samuel G. Thompson, all of Philadelphia, were chosen managers. Messrs. Gaskill, Derbyshire and Thompson are new directors, taking the places of Washington Butcher, H. D. Moore and John Noblit.

—At the annual meeting of the West Jersey Railroad Company, at Camden, N. J., recently, the following gentlemen were elected directors for the ensuing year: Samuel A. Whitney, Glassboro, N. J.; Thomas Jones Yorke, Camden, N. J.; H. J. Mulford and Charles E. Elmer, Salem, N. J.; C. F. Leaming, Cape May Court House, N. J.; Lewis Mulford, Millville, N. J.; John M. Moore, Clayton, N. J.; Josiah Bacon, George B. Roberts, Edward C. Knight, Samuel T. Bodine, George Wood and Strickland Kneass, of Philadelphia. Messrs. Kneass and Wood are new directors, replacing Washington Butcher and Edmund Smith. The board of directors re-elected T. Jones Yorke, President, and George J. Robbins, Secretary and Treasurer.

—The City Council of Baltimore has elected the following directors on the part of the city in the Baltimore & Ohio Railroad Company: Messrs. W. H. Cole, John S. Bullock, John G. Medinger, James Webb, John F. Wiley, R. T. Banks and Simon J. Kemp. Messrs. Wiley, Banks and Kemp take the place of Messrs. A. H. Dillon, Wm. A. Boyd and A. P. Burt, of the old board. The others are re-elected.

—At the annual meeting of the stockholders of the Macon & Brunswick Railroad Company, held in Macon, Ga., February 6, the following gentlemen were elected directors to serve for the ensuing year: George H. Hazlehurst, M. K. Jesup, J. P. G. Foster, H. W. Gray, J. Milbank, W. R. Phillips, Stephen Collins, L. N. Whittle, I. C. Plant. Messrs. Phillips and Collins take the places of John Screven and J. H. Hammond.

—W. L. Durbin, J. P. Westerfield, George Huygins and D. W. Brinkerhoff have been appointed train dispatchers on the St. Louis, Kansas City & Northern Railway, with authority to move trains by telegraph. S. A. Johnson will have authority to move trains on the St. Joseph Branch.

—Mr. A. R. Van Gieson has been appointed Train Master on the St. Louis, Kansas City & Northern Railway, and was placed in charge of the Transportation Department February 15.

—At the annual meeting of the Painesville, Warren & Pittsburgh Railroad Company, recently, R. McCormick, H. H. Hines, G. E. Paine, S. H. Kimball, Samuel Moody, H. R. Dickenson and H. P. Sanford were re-elected directors. The board subsequently re-elected the old officers, as follows: President, George E. Paine; Vice-President, H. R. Dickenson; Secretary and Treasurer, Robert McCormick.

—The St. Joseph (Mo.) Bridge Company chose the following board of directors for the ensuing year at the annual meeting February 11: Willard P. Hall, D. D. Mason, W. B. Johnston, Robert Gunn, I. G. Kappner, E. D. McNeely, James McCord, Louis Hax, G. H. Koch, Jeff. Chandler, W. M. Wyeth, R. L. McDonald. Milton Tootle. Messrs. Mason, Johnson, Kappner, McCord, Hax, Wyeth, McDonald and Tootle are new directors.

—A circular from the General Superintendent's office of the Chicago, Burlington & Quincy Railroad announces that Assistant Superintendent C. H. Chappell has been transferred from Burlington to Aurora, and will hereafter have charge of the distribution of freight cars on that road and its leased lines, and will attend to such other duties as may be assigned to him. Mr. E. C. Brown has been transferred to Burlington, Ia., as Division Superintendent, and will have supervision of the Burlington & Missouri River Railroad and branches, the Burlington & Keokuk and the Burlington & Carthage branches.

—At the annual meeting of the Vermont & Massachusetts Railroad Company, at Fitchburg, Mass., February 12, the old board of directors was unanimously re-elected, as follows: Daniel S. Richardson, Lowell, Mass.; W. H. Hill, Brookline, Mass.; James A. Dupee, Boston; George F. Fay, Fitchburg, Mass.; Francis Goodhue, Brattleboro, Vt.; W. P. Davis and Thornton K. Ware.

—At the annual meeting of the Boston & Albany Railroad Company, held in Boston, February 12, the following board of directors was chosen for the ensuing year: Chester W. Chapin, of Springfield, Mass.; D. Waldo Lincoln, of Worcester, Mass.; Henry Colt, of Pittsfield, Mass.; B. E. Gillette, of Westfield, Mass.; Ignatius Sargeant and Ginery Twichell, of Brookline, Mass.; George O. Crocker and James M. Beebe, of Boston. Messrs. Crocker, Gillette and Beebe are new directors, replacing Josiah Stickney, Daniel Denny and S. M. Crosby.

—Mr. Frank Thompson has been appointed Superintendent of Motive Power of the Pennsylvania Railroad, in place of G. Clinton Gardner. Mr. Thompson has been Superintendent of the Eastern Division of the Philadelphia & Erie Railroad.

—Mr. Thomas Gucker has been appointed Superintendent of the Eastern Division of the Philadelphia & Erie Railroad, in place of Frank Thompson, who has accepted an appointment on the Pennsylvania Railroad. Mr. Gucker has been assistant to Mr. Thompson.

—Mr. George Clark, late of Williamsport, Pa., has been appointed Train Master at Pittsburgh, on the Pittsburgh, Cincinnati & St. Louis Railway.

—Mr. T. J. Charlesworth has resigned the General Superintendency of the Chicago, Danville & Vincennes Railroad, and accepted an appointment as Superintendent of the Lansing Division of the Lake Shore & Michigan Southern Railway. Mr. Charlesworth came from the Kalamazoo Division of the Lake Shore to the Danville road last summer.

—Mr. Thomas Warnock has been appointed Auditor, and H. S. Jantzen Assistant Treasurer of the Atlantic & Great Western Railway.

TRAFFIC AND EARNINGS.

—The earnings of the Erie Railway for the first week in February were: 1873, $302,842; 1872, $323,514; decrease, $20,672, or 6⅜ per cent.

—The earnings of the Kansas Pacific Railway for the first week in February were: from passengers, $16,425.70; freight, $23,338.85; mail, $2,055.31; total, $41,819.86. Of this amount, $2,207.07 was for transportation of troops, mails and government freight.

—The earnings of the Great Western Railway of Canada for the week ending January 24, were: 1873, £17,599; 1872, £17,289; increase, £310, or 1¾ per cent.

—The earnings of the Grand Trunk Railway for the week ending January 25, were: 1873, £27,500; 1872, £33,300; decrease, £5,800, or 17⅜ per cent.

—The earnings of the St. Croix & Penobscot Railroad for the year 1872 were: from passengers, $10,677.24; freight, $73,437.69; mails and sundries, $3,637.74; total, $87,752.67. This is an increase of $7,099.87, or 8¾ per cent. over the preceding

year. The expenses were $50,834.75, or 68¼ per cent. of the earnings, and the net earnings were $27,917.92. The gross earnings were at the rate of $3,989 per mile. The road extends from Calais, Me., to Lewy's Island, 22 miles.

—The earnings of the Fort Wayne, Jackson & Saginaw Railroad for the year 1872 were $280,647.63, of which $131,655.71 were for freights, and $90,292.89 for passengers. The gross expenses were $236,431.82, leaving the net earnings $44,215.81. The gross earnings were at at the rate of $2,806 per mile.

—The earnings of the St. Louis & Southeastern Railway (consolidated) for the first week in February were $23,953.16.

—The earnings of the Great Western Railway of Canada for the week ending January 31 were: 1873, £15,777; 1872, £16,359; decrease, £582, or 3½ per cent.

—The earnings of the Grand Trunk Railway for the week ending February 1 were: 1873, £28,800; 1872, £30,400; decrease, £1,600, or 5¼ per cent.

PERSONAL.

—Mr. Jackson Richards, Master Mechanic of the Philadelphia, Germantown & Norristown road, was recently presented with a valuable gold watch and chain by the enginemen and firemen on the road.

—Colonel C. W. Fisher, Superintendent of the Denver Division of the Kansas Pacific and Denver Pacific railways, was recently presented with a horse, buggy, harness, &c., valued at $900, by the employees of the road.

—Mr. H. H. Smith, President of the Detroit & Bay City Railroad Company, was recently presented with a handsome silver tea-set.

—Colonel F. M. Smith, Western Passenger Agent of the Chicago, Burlington & Quincy Railroad Company, died at his residence in Kansas City, Mo., on the morning of February 7.

—Frank B. Lord, formerly General Ticket Agent of the Indianapolis, Cincinnati & Lafayette Railroad died of consumption at his residence near Cincinnati, on the morning of the 10th.

THE SCRAP HEAP.

Railroad Manufactures.

The works of the Lake Erie Iron Company at Cleveland were destroyed by fire on the morning of February 2. The buildings were entirely destroyed, and the machinery, steam hammers, etc., damaged. The loss is stated to be $70,000, on which there is an insurance of about $60,000.

Porter Bell & Co., of Pittsburgh, have just completed 18-ton shifting locomotives for the Superior Rail Mill, of Pittsburgh, the Carbon Iron Company and a firm at Pottsville, Pa. They have also lately completed the third passenger locomotive for the Cairo & St. Louis narrow-gauge road and two mining engines for the Sutro Tunnel Company in Nevada. They are constructing four locomotives for the narrow-gauge division of the Colorado Central, built with special reference to the heavy grades on that road. They now employ 180 men.

The Atlantic Car Works at Salem, Mass., have just closed a contract for ten first-class passenger and 100 freight cars for the Boston & Maine Railroad. Four passenger cars for the Eastern and 15 for the New York Central & Hudson River road are now being built at the works.

A Pleasant Traveling Companion.

A man with a suspicious looking bundle recently got upon a train of the Oil Creek & Allegheny River Railroad and took a seat in the smoking car. The conductor proceeded to investigate the bundle soon afterwards and found that it contained a number of oil well torpedoes filled with nitro-glycerine. The train was stopped and the man with his torpedoes ordered off at once.

OLD AND NEW ROADS.

[Continued from page 73.]

Lynchburg to New Orleans.

On the 17th, a line of Pullman sleeping-cars began to make regular trips between Lynchburg, Va., and New Orleans, by way of Knoxville and Cleveland, Tenn., Dalton, Atlanta and West Point, Ga., Montgomery and Mobile, Ala. This route, which is not the most direct possible, is called the "Kenesaw Route." The distance by this route from New Orleans is 1,036 miles to Lynchburg, and to New York 1,442 miles.

Boston, Hartford & Erie.

It is reported that there is a movement on foot to put this road under the management of William H. Vanderbilt.

Erie.

A resolution has been introduced into the New York Legislature, providing for legal proceedings to prevent the payment of dividends on the issues of stock made without consideration.

Goat Island.

The Senate Committee on Military Affairs has reported without recommendation the House bill giving the Central Pacific the use of this island.

International & Great Northern.

The time table, dated February 9, shows one passenger train and one freight running between Houston and Longview (the passenger, 234 miles in 13½ hours); one mixed train between Houston and Huntsville (73 miles in six hours); one freight between Houston and Palestine (150 miles); one mixed train between Palestine and Troupe (46 miles); and one mixed train on the "Brazos Division" (Palestine to Hearne, 91 miles).

Alabama & Chattanooga.

The Governor of Alabama, on the 3d inst., submitted to the Legislature for its sanction and approval a provisional contract for the sale of this road to G. Ingraham, President of the New Orleans & Northeastern Railroad Company. The sale made on the 17th of August last to Henry W. Paine & Co., conditional on the performance of certain conditions, has not been consummated, by reason of the failure of the purchasers to make any payment. The new purchasers, the Governor believes, will be able to meet their engagements, certain cash payments being required in the beginning. They are said to intend to enter into a scheme for the introduction of European immigrants into the counties on the line of the road.

Elizabethtown & Paducah.

On the 6th the Louisville Common Council approved the contract between this company and the city, by which the former is to receive $1,000,000 of the city's bonds to apply to the construction of a branch from Louisville southwest to the main line.

Railroad Subsidies in Kansas.

The aggregate indebtedness of the counties, cities and towns in Kansas, arising from subscriptions voted in aid of railroads, is said to amount to $8,000,000 at this time.

Worcester & Boston.

Of this road the Springfield *Republican* says that it begins to look like a live project. The surveys are completed, and it is proposed to ask for a charter. The route talked of runs through Shrewsbury, Boylston and West Boylston, joining the Central road close upon the line between Boylston and Clinton, near the corner of Berlin. The length of the line is 11½ miles and the heaviest grades, near Worcester, 60 feet to the mile. The distance to Boston, by way of the Central, will be 45½ miles—about a mile more than by the Boston & Albany; but the projectors seem sanguine of its beneficial effects upon the business of Worcester.

Worcester & Shrewsbury.

The line of this narrow-gauge railroad (2½ miles long) has been located, the stock is all taken, and construction will begin. It is likely to be the first narrow-gauge railroad in New England.

Humboldt & Colorado River.

This company, recently organized under the general law of Nevada, purposes to build a railroad from Palisade, Nev., south 82 miles to Eureka, and thence southeast passing near Hamilton to Pioche and turning southward again to Callville, Arizona, the head of navigation on the Colorado River, 140 miles from Pioche. The whole length of the line will be about 380 miles, and much of the country through which it will pass is almost entirely uninhabited. It will, however, reach a number of isolated mining districts.

Montclair.

A party composed of officers of the company, prominent rail road men and capitalists recently passed over this newly-completed road in an excursion train. The officers of the company took occasion to contradict statements recently made that the road cost $6,000,000, and reported that the whole amount expended was $3,500,000, and that out of this sum a considerable amount of work has been done on the Morristown Branch and on the Watchung Railroad. The grading on the two miles from the present terminus at Monk's to Greenwood Lake is about completed, and rails will be laid in the spring.

It is announced that as soon as spring opens and the ballasting of the road can be completed, a number of trains will be put on and a strong effort made to build up the suburban traffic by a system of low fares and frequent trains. The road passes through a very beautiful country, hitherto comparatively unknown, and there is no doubt that a large traffic can be built up in time by proper measures.

Penobscot Bay & River.

It is reported that a New York contractor offers to build this railroad from Rockland to Winterport, Me., for $30,000 a mile, and from Winterport to Bangor for $35,000 a mile. He will also invest $300,000 in the road.

Terre Haute & Indianapolis.

A suit is being prosecuted against this company for alleged violation of its charter. A section of the charter provides that when the aggregate amount of dividends declared shall amount to the full sum invested and ten per cent. per annum thereon, the Legislature may so regulate the tolls and freights that no more than 15 per cent. shall be divided, and the surplus profits, if any, after paying contingencies, shall be paid over to the Treasurer of the State for the use of the common schools.

The company asserts its willingness to pay to the State any amount which may be found to be due by proper legal proceedings, but argues that all the earnings of the company belong solely to the corporation until the State has first asserted her right to the surplus profits by the regulation of the tolls and freights. The prosecutors claim that no legislation is needed to assert the right of the State. But another question is involved in the suit, before it can be decided whether anything is due to the State. If there is anything due, it grows mainly out of the company's having diverted the earnings of the road, which would otherwise have been dividends, for the purpose of subscribing for stock and purchasing bonds of other railroad companies, to enable such companies to complete railroads forming a connection with the roads of said company. The officers of the company insist that they have the right to do so. The attorneys claiming to represent the State insist that the corporation has no such right. The officers of the road insist that if such investment had proven a total loss, the investment increased the business and dividends of the road and thus enured to the benefit of the school fund by enabling the company to get back sooner its investment, and put the State in a condition sooner to regulate the toll and freights.

The company claims to have kept good faith with the State, and is anxious to have the legal questions settled. The question was brought before the Legislature, but the Senate Committee on Railroads, to which the matter was referred, refused to make any recommendation, and it is probable that the question will be left to the courts.

North Pacific Coast.

Work on this narrow-gauge road is shortly to be commenced, the contract for the tunnel through White's Hill, in Marin County, Cal., having been let to White & Bugbee. The tunnel will be 1,250 feet long, most of it through rock. The road is to extend from Saucelito, on the north side of San Francisco Bay, north to Humboldt Bay, nearly 200 miles.

The Detroit Tunnel.

The Detroit Board of Trade having passed resolutions in favor of a bridge over the river at that point, assuming that the tunnel has been shown impracticable, or at least too costly for the purpose for which it was designed, by the difficulties encountered in the drainage tunnel, the Detroit *Post*, of the 6th, has made inquiries of the engineer in charge of the work, and finds quite a different condition of things, as reported below:

"Upon this side of the river the drainage tunnel has been pushed out nearly to the middle of the river, a distance of 1,200 feet, where work was suspended to commence operations on the other side. The difficulties met with on this side were numerous, but not by any means of an insuperable character. The tunnel is, for most of the way, immediately upon the bed-rock and through a sort of drift or boulders and gravel mixed with clay and pockets of sand. The removal of these boulders in a tunnel of such small dimensions—it being but five feet in diameter—was a work of considerable difficulty. Foul gases were also met with on the surface of the rock, the disposition of which was a matter of some difficulty. But all these things did not stop the work or even hinder it to any important extent. As these were the only difficulties met with, and as they are peculiar to the formation immediately incumbent upon the rock, and not to the solid clay through which the main tunnel will be constructed, there is no apprehension of delay from them in that portion of the work. The engineer has not the slightest apprehensions of foul gases in the main tunnel. In the first place, they do not exist in the clay; and, in the second place, the tunnel will be encased in a wall of solid brick or stone laid in cement, which is expected to exclude both gas and water, if any of either should be met with.

"A point about midway of the river having been reached, work was suspended on this side, and operations were commenced on the Canada side. There the drainage tunnel had been extended about 400 feet when veins of quicksands of unknown extent were met with, which have delayed the work considerably. These veins were of a thickness varying from a few inches to two feet. The lateral extent of them is not known, but it is deemed probable that they can be drained. At the point stated work was suspended on the drainage tunnel, and an exploration drift was commenced at about the same depth and about parallel with the drainage tunnel. This has now been extended over 400 feet, and no obstructions whatever have been met with. The quicksands which gave trouble in drainage tunnel have not been found, although the explorations have already been made beyond the point where they were met with before, which would tend to show that they are not of very great extent. This exploration drift has not been walled up, and is not expected to be of any further use than to demonstrate the extent of the quicksands, and perhaps drain them from the tunnel so as to allow the work to proceed. But little more than half the drainage tunnel has yet been built, but it is expected that it will be completed this summer, if no more serious obstructions are met with than those which have been already encountered and overcome.

"The engineer still asserts his faith in the success of the project. The building of the drainage tunnel thus far has consumed more time and has cost more than was at first anticipated. But this was entirely an experiment, as nothing whatever was known of the nature of the earth to be penetrated, and hence there were no reliable data on which to base an estimate of time and cost. But, aside from the additional time and expense incurred, there has been nothing, to the mind of the engineer, of a discouraging nature. It was considered by him that the construction of the drainage tunnel was the most doubtful and difficult part of the work, and hence he was determined to build that first. He still adheres to the opinion expressed by him at the outset, that the main tunnel can be built *within two years* from the date of its commencement. He has yet seen nothing to cause him to change his mind on that point, or to lead him to doubt the feasibility of building a railroad tunnel under the river at this point."

Lyme & Colchester.

The surveys for this road, from Lyme, Conn., on the Shore Line Division of the New York, New Haven & Hartford Railroad, north to Colchester, a distance of about 20 miles, have been completed. The estimated cost of the road and equipment is a little over $500,000, or about $25,000 per mile. The district through which it will pass is not at present very well provided with railroad facilities.

Peoria, Atlanta & Decatur.

The Atlanta (Ill.) *Herald*, of February 6, says:

"It will be remembered that a few of the taxpayers of Atlanta township, some months since, asked for an injunction to restrain the levying of a tax to pay interest on the bonds issued in aid of the Peoria, Atlanta & Decatur road. Judge Tipton has recently made the injunction perpetual. As we understand it, no tax can be levied till the road is completed to the township line."

Memphis & Charleston.

The Memphis (Tenn.) *Avalanche*, of February 8, says:

"The Board of Directors of the Memphis & Charleston Railroad Company, at their meeting yesterday, resolved to issue the income bonds of the company, but not until the company is authorized to do so by the General Assembly now in session at Nashville. Immediate steps will be taken to obtain the passage of an act to this effect."

Pittsburgh & Bellefontaine.

This company has filed its certificate of incorporation with the Secretary of State of Ohio, and proposes to build a railroad from Loudonville, in Ashland County, through Ashland, Richland, Knox, Morrow, Marion, Delaware, Union and Logan counties, to Bellefontaine. At Loudonville connection will be made with the Pittsburgh, Fort Wayne & Chicago, and at Bellefontaine with the Cleveland, Columbus, Cincinnati & Indianapolis, and the Cincinnati, Sandusky & Cleveland roads. The line will be about 90 miles long. The capital stock is to be $1,000,000, and the corporators are G. W. Kemp, E. J. Howenstine, H. Cassell, E. Dix, T. P. Cratty, N. B. Wigatt and I. N. McBeth.

Utica, Chenango & Susquehanna Valley.

At a meeting called for the purpose, held in Utica, N. Y., February 12, it was resolved to increase the capital stock from $3,000,000 to $4,000,000. It was also resolved that before the new stock to be issued be delivered to the Delaware, Lackawanna & Western Railroad Company, the directors of the latter should give a receipt to the stockholders of the Utica,

RAILROAD EARNINGS FOR JANUARY, 1873.

Name of Road.	Mileage. 1873.	Mileage. 1872.	Increase. Miles.	Increase. P. c.	Earnings. 1873.	Earnings. 1872.	Inc.	Dec.	Per cent.	Earnings per Mile. 1873.	1872.	Inc.	Dec	P.c
Atlantic & Great Western	539	506	33	6½	$374.718	$372,845	$1,873	.....	0½	$695	$735	....	$40	5½
Atlantic & Pacific	328	328	.....	.....	86,854	80,594	6,260	.....	7¾	265	246	19	....	7¾
Burl., Cedar Rapids & Minnesota	334	261	73	28	61,362	65 319	.....	3 956	6	184	250	....	66	26¼
Central Pacific	1,166	1,013	153	15⅛	852,660	592,223	260,637	.....	44	731	585	146	....	25
Chicago & Alton	650	600	50	8⅓	352,538	372,316	.....	19,778	5¼	542	621	..	79	12¾
Cleve., Col., Cin. & Indianapolis	470	390	8	20	358,612	34 791	17,821	.....	5¼	763	874	....	111	12¾
Erie	971	956	15	1½	1,316 831	1,333,310	.....	16,479	1¼	1,356	1.395	....	39	2¾
Illinois Central	1,109	1,109	.....	.....	5-0,499	637.459	.....	16 93	9	523	573	....	50	9
Kansas Pacific	672	672	.....	.....	159.567	189,606	.....	39,039	20½	224	282	..	58	20½
Lake Shore & Michigan South'n	1,096	1,038	58	5½	1,412 368	1,276,150	135,218	.....	10⅝	1,289	1 229	60	....	4¾
Marietta & Cincinnati	284	2-4	.....	.....	170,023	152,577	17,446	.....	11½	5 9	537	62	....	11½
Missouri, Kansas & Texas	641	476	165	34½	200.639	49,302	151,337	.....	307	313	104	209	....	201
Michigan Central	715	715	.....	.....	475.897	5 5.586	.....	29,689	5⅞	666	707	....	4	5⅞
Ohio & Mississippi	393	393	.....	.....	277 776	273,024	4,752	.....	1¾	707	695	12	....	1¾
Pacific, of Missouri	471	355	116	32¾	247,897	246,831	.....	18 933	7⅝	4-4	695	....	21	30¾
St. Lo., Alt. & Ter. H'te, Main Line	266	266	.....	.....	105,925	119,814	.....	13,889	11½	398	450	..	52	11½
" " " Branches	71	71	.....	.....	43,337	38,284	= 5,053	.....	13¼	610	539	71	....	13¼
St. Louis & Iron Mountain	285	224	61	27¼	146.160	173.707	.....	27,547	15⅞	513	775	....	262	33⅞
St. Louis & Southeastern	357	357	.....	.....	83.126	64,397	18,729	.....	29⅛	233	180	53	....	29⅛
Toledo, Peoria & Warsaw	237	227	10	4⅜	79.591	108,188	.....	28 597	26½	336	477	....	141	29½
Toledo, Wabash & Western	628	628	.....	.....	370,290	439,780	.....	69,490	15¾	590	700	....	110	15¾
Total	10,683	9,869	814	8¼	$7,727,871	$7,432,073	$620.126	$324.328	.....	723	753	....	30	4
Total increase	.....	.....	.....	.....	.....	.....	295,798	.....	4	..	..	....	....	....

Chenango & Susquehanna Valley Railroad Company, stating the purposes for which the stock was received, and that the issue of it should not affect the rights of the stockholders under the lease. Also that this stock should bear the same rate of interest and stand upon the same footing as the stock guaranteed by the company at the time of the lease. The number of shares voting in favor of the resolutions was 26,193, or 6,198 more than the two-thirds required by law. The increase is for the purpose of meeting expenses incurred in extending the road and improving it according to the contract with the Delaware, Lackawanna & Western Railroad Company.

Hannibal & St. Joseph.

A bill is now before the Missouri Legislature to authorize this company to increase its capital stock by the issuing of preferred stock to draw 7 per cent. interest. This preferred stock is to enable the company to build a branch railroad from Hannibal to St. Louis; to substitute steel rails for iron rails on the main trunk, and enable it to pay off the maturing bonds, the payment of which is guaranteed by the State. The bill provides that the assessment of stock shall be limited to the cost of the proposed improvements.

St. Louis, Hannibal & Keokuk.

A special meeting of the stockholders of this company is called to be held at Hannibal, Mo., March 4, to take into consideration the lease or purchase of the St. Louis & Keokuk and the Pike County Short Line Railroads, or a consolidation with said companies, and to ratify the agreements already made by the board of directors.

Albany & Susquehanna.

The tunnel on this road three miles above Binghamton, N. Y., has lately been completed. Work on this tunnel was commenced about twenty years ago and continued for a year, when it was suspended for nearly twelve years. Work was again commenced seven years ago, and the tunnel has been completed so that trains could pass through for nearly four years, but the arching and mason work was not finally finished until a few weeks since.

Alameda, Oakland & Piedmont.

This newly-organized company intends to build a narrow-gauge railroad from Oakland, Cal., opposite San Francisco, south to Alameda, about eight miles. The capital is $100,000.

Cincinnati, Sandusky & Cleveland.

A correspondent of the Cleveland (O.) *Herald* says that it is reported that negotiations are pending for the sale of this road to the Lake Shore & Michigan Southern Company. The road extends from Sandusky, O., southwest to Springfield, 130 miles, with a branch from Carey, 50 miles from Sandusky, northwest to Findlay, 16 miles, and a leased branch from Springfield east to Columbus, 45 miles.

Flint & Pere Marquette.

This company has closed a contract with Captain E. B. Ward, of Detroit, to carry 20,000,000 feet of lumber per year for him, for the next 15 years. The lumber will be brought from Ludington. This would make about 2,800 car-loads.

Fredericksburg, Orange & Charlottesville.

A bill has been introduced in the Virginia Legislature authorizing this company to extend its road from Fredericksburg east to Matthias' Point, on the Potomac, and also to build a road from Fredericksburg to some point on the Chesapeake & Ohio road east of Gordonsville. This, it is said, will give the company authority to construct a line between Richmond and Washington in the interest of the Southern Security Company. A strong opposition to the bill is being made by the friends of the Richmond, Fredericksburg & Potomac Company.

Paducah & Northeastern.

This newly-organized company intends to build a railroad from a point in Massac County, Ill., opposite Paducah, Ky., north about 50 miles to a connection with the St. Louis & Southeastern and the Springfield & Illinois Southeastern roads above Shawneetown.

Greenwood & Augusta.

The preliminary surveys of this road from Augusta, Ga., north to Greenwood, S. C., a distance of about 60 miles, have been completed. Maps and estimates are to be prepared at once. At Greenwood the road will connect with the Greenville & Columbia road.

The State of Mississippi and its Railroads.

Gov. Ridgely C. Powers, of Mississippi, in his recent annual message, reports that under the act of April 4, 1872, authorizing him to settle with railroads, he received an accepted draft on New York from the New Orleans, Jackson & Great Northern Company in full payment of its debt, with the promise that he would hold it until January 1, 1873, before presenting it for payment, giving the company the opportunity meanwhile to pay its debt in State warrants. By that date he had received in State warrants $151,898, and continues to hold the draft, intending to give the company until March 1 to pay in warrants for the balance.

This law has now expired and the debts of the Mobile & Ohio, the Mississippi Central and the Mississippi & Tennessee remain unpaid. During the years 1857 and 1858, the State loaned these roads money amounting in the aggregate to $800,000, and received as security for the payment of the same, notes and bonds of the companies. Up to the breaking out of the war the annual interest was punctually paid, and under an act of the Legislature passed in 1863, the companies came forward and paid up their indebtedness, and withdrew their collaterals. Notwithstanding this, the State constitutional conventions, which assembled in 1865 and 1868, refused to recognize the validity of this settlement, and the courts have since held that the State is entitled to recover the amount of the debt.

The act of April 4, 1872, was intended to give the companies an opportunity to settle these claims. The New Orleans, Jackson & Great Northern, which settled under this law, did not settle under the law of 1863, when the State was acting as one of the Confederate States. The Governor recommends that the law of 1872 be re-enacted, with the further proviso that the companies shall not be required to pay interest in case they make settlements within a reasonable period.

Governor Powers gives the following account of the work done on new railroads in the State during the past year:

"Memphis & Selma road, 80 miles graded, and on 60 miles of it bridges have been built and cross-ties delivered.

"Mobile & Northwestern, 30 miles graded, bridges constructed and cross-ties distributed.

"Vicksburg & Ship Island, 20 miles graded and cross-ties delivered.

"Vicksburg & Memphis, 8 miles graded, 1,200 feet of trestle work completed, and 10,000 cross-ties delivered.

"Vicksburg & Nashville. 20 miles ready for the iron and no debt incurred.

"Prentice & Bogue Phalia, grading all completed ready for the iron.

"Natchez, Jackson & Columbus road, 13 miles graded and bridged; construction train and 170 tons of iron delivered, and a large cash balance in the treasury.

"The companies in charge of these enterprises are dependant almost exclusivoly upon private aid and county subscriptions for means to carry them forward. The people generally are disposed to subscribe to the extent of their ability, and counties have in some instances voted such liberal aid as will lead to embarrassments when their obligations come to maturity.

"The Ripley Railroad was the only one entirely equipped during the year. The great energy displayed by this company enabled it to complete, before the 1st day of September, 1872, the number of miles necessary to entitle it to receive a subsidy."

This subsidy, to the amount of $81,968.20 in State warrants, was issued to the President of the company, but under advice from the Attorney General the State Treasurer refused to receive them for taxes; but as they had been audited the Governor took the responsibility of accepting them in payment of a debt of a railroad company.

The act granting a State subsidy to new railroads ($4,000 per mile) expired September 1, 1872. The Governor recommends that it be not re-enacted, in the present financial condition of the State.

The Narrow Gauge in Wales.

Although the Festiniog Railway has been in operation for many years in Wales, and has been the text of most of the numerous articles by English engineers and others, including the two leading engineering journals of Great Britain, lauding such roads as very much more economical than railroads of the standard gauge, we have not heard that it has been even seriously proposed to construct any other narrow-gauge railroads anywhere in Great Britain until very recently. English journals of the 25th ult. have advertisements of forming an issue of £66,000 in shares of the "North Wales Narrow-Gauge Railway Company," which is to be applied to the construction of 14 miles of railroad similar in character to the Festiniog, from a junction with the Carnarvonshire Railway to the Moel Tryfan, with a branch to Bettws Garmon. This issue of shares is at the rate of $23,570 a mile. The company intends to build another line 23 miles long to Port Madoc, which is to have a share capital of $32,600 per mile.

Utah Railroad Projects.

The following new companies have lately been organized in Utah:

The Wasatch & Jordan Valley Railroad Company purposes to build from Sandy Station on the Utah Southern to Alta, in Little Cottonwood Cañon. The road is to be of three-feet gauge with a third rail for the standard gauge laid from Sandy to the mouth of the Cañon. About seven miles of grading is completed and some iron purchased.

The Bingham Cañon & Camp Floyd Company has some 10 miles of grading done on a line from Sandy Station on the Utah Southern to Bingham City. The gauge is 3 feet, with a third rail for standard gauge from Sandy to the Jordan River.

The Salt Lake & Tooele Valley Company purposes building a road hrough Tooele City and the Rush and Sevier valleys to Pioche, Nev., about 100 miles.

The Salt Cake City, Sevier Valley & Pioche Company also intends to build a railroad from Salt Lake to Pioche on very nearly the same route as the above.

The Juab, San Pete & Sevier Company intends to build a line of 3-feet gauge from Lehi on the Utah Southern through Salt Creek Cañon to some coal beds.

The Lehi & Tintic Company purposes constructing a road of 3-feet gauge from Lehi southwest to the East Tintic mining district, about 50 miles.

The Utah Southeastern Company is organized to build a narrow-gauge road from the Utah Southern at Springville through Spanish Fork to San Pete, about 100 miles.

Philadelphia & Norristown.

A new railroad from Philadelphia to Norristown is talked of, the line of which is thus described:

"The proposed line runs through Upper Conshohocken, Spring Mill and Lafayette, and skirting the brow and sides of the hills which shelter the eastern bank of the Schuylkill, entering and passing through Manayunk just above the 'Dripping Rock,' passing through the upper portion of East Manayunk, crossing the Wissahickon, continuing along the rising ground above 'Falls Station,' and striking Broad street at some point adjacent to where the Germantown & Norristown road now crosses it."

It is also proposed to carry the road under Broad street, either by a tunnel or by an open cut arched over.

Macon & Brunswick.

Surveys are being made for the proposed extension from Hawkinsville, the terminus of the Hawkinsville Branch, west to Columbus, Ga.

Elkhart & Lake Michigan.

The city of Elkhart, Ind., has voted $30,000 in aid of this road. The disputed right of way question has been settled.

Bonsack's & Clifton Forge.

A railroad is proposed, to extend from Bonsack's, on the Atlantic, Mississippi & Ohio road, 48 miles west of Lynchburg, north through the valley to Clifton Forge, on the Chesapeake & Ohio. The road would be about 38 miles long, and would serve as an outlet to a fairly productive country.

Davenport & St. Paul.

The town of Lime Springs, Iowa, has voted to transfer to this company the bonds formerly voted to the Winona & Southwestern road but not issued.

International & Great Northern.

This company now issues tickets good for 1,000 miles of travel over any of its lines, the holder being privileged to travel any distance, greater or less, at one time; to carry with him 100 pounds of freight, and to travel on either freight or passenger trains. The tickets are sold for $35, or three and one-half cents per mile.

Houston & Texas Central.

Texas papers report that this company is having surveys made of a line from Waco, Texas, the present terminus of the Waco & Northwestern Branch, northwest to Fort Worth, on the line of the Texas & Pacific.

Southern Maryland.

An agreement has been entered into between this company and the Washington City & Point Lookout Railroad Company. The latter company is to construct the line from Washington to Brandywine, the crossing of the Pope's Creek line of the Baltimore & Potomac; and the Southern Maryland Company will build the line from Brandywine to Point Lookout, and will then lease the Washington end and operate the whole as one line. About 30 miles of grading below Brandywine is completed, and the rails will be laid next season.

Grand Rapids & Indiana.

A committee of the Michigan Legislature is now investigating the management of this company, it having been charged that the company is constantly violating the law under which it was organized.

Columbus (O.) Union Depot.

The plans for this depot have been prepared by M. J. Becker, Chief Engineer of the Pittsburgh, Cincinnati & St. Louis, and Frank Ford, Chief Engineer of the Cleveland, Columbus, Cincinnati & Indianapolis road, and submitted to the Union Depot Company. Some slight changes in the plans are to be made, and proposals will then be advertised for. The plans are thus described by the Columbus *State Journal*:

"The building will be 600 feet long and 185 feet wide, and will contain seven tracks. Trains will enter and depart through arch doorways, which will be furnished with doors that may be closed when desirable. Thirty-six feet on the south side will be devoted to ticket office, waiting rooms, lunch and dining rooms, baggage room, telegraph offices, etc., etc.—with a passenger platform in front. The design contemplates a depot which will be thoroughly modern. The building will be of brick, with an iron roof, and will probably cost $200,000."

Madisonville & Bowling Green.

This road is to extend from Madisonville, Ky., on the St. Louis & Southeastern road, southeast to Bowling Green, on the Louisville & Nashville road, a distance of 80 miles. The surveys are completed, and it is hoped that work will be commenced in the spring.

Chesapeake & Ohio Canal.

The President of this company has entered a protest against a bill now pending in Congress for the improvement of the river front at Washington. The bill provides that the commissioners to be appointed under it may take possession of and close up the canal from Seventeenth street in Washington to Georgetown, and also to remove the dam at Rock Creek. The company claims that this will be injurious to its property and business, and an interference with its vested rights.

New Mail Route.

The Post Office Department has ordered an extension of mail service over the Bridgeton & Port Norris Railroad, from Bridgeton, N. J., to Port Norris, 21 miles.

Montreal & Plattsburgh.

The St. Albans (Vt.) *Messenger*, of February 7, says:

"The New York & Canada Railroad has purchased the Montreal & Plattsburgh Railroad and the steamer Oakes Ames, and taken a perpetual lease of the branch of the Whitehall & Plattsburgh Railroad now running south to Point of Rocks. One of the conditions is that they are immediately to complete the road from Plattsburgh to Port Henry, and another that they are to continue to operate the branch road to the Point of Rocks."

The Montreal & Plattsburgh road, which is now leased by the Vermont Central, extends from Plattsburgh, N. Y., north to the Canada line, 23 miles, and is extended to Montreal by the Montreal, Lachine & Province Line Division of the Grand Trunk Railway. The Whitehall & Plattsburgh, Northern Division, extends from Plattsburgh south to the Ausable River, 20 miles. The possession of these roads would save the Delaware & Hudson Canal Company, which is building the New York & Canada road, the construction of some 40 miles of new road.

New York, Boston & Montreal.

A large ferry steamer, capable of carrying several loaded freight cars, is to be built to run between Dutchess Junction, the Hudson River terminus of the Dutchess & Columbia Division, and the depot of the Erie Railway at Newburg.

Stafford Beach.

The charter asked for by this company gives it authority to construct a railroad from Stafford Beach, in Burlington County, N. J., through or near Mannahawkin to a connection with any railroad now built or hereafter to be built in Burlington or Ocean County, provided the road shall not extend beyond the line of the Camden & Burlington County road.

Northern Pacific.

Mr. C. W. Meade, General Manager, states that trains have run regularly on schedule time all winter from Duluth, Minn., to Moorhead, on the Red River of the North, without delay or obstruction from snow, except for two days during the great storm of January 8 and 9, during which time all trains were suspended by orders from headquarters, waiting for the storm to close. On the following day the whole road was opened, and there has been no delay since. The snow fences have proved to be a very complete protection of the track. The thirty miles of track required to reach the Missouri will be laid as soon as the season opens and a line of boats put on to run to Fort Benton, 1,200 miles up the river, as soon as navigation opens.

Quincy, Missouri & Pacific.

This company has made surveys for an extension from Kirksville, Mo., in a southwesterly direction to a point on the Burlington & Southwestern about half way between Browning and Milan, and thence due west to Trenton. The old route is through Milan and is said to be longer and more difficult, but if the new one is chosen it will be necessary to give up a subscription of $200,000 offered by Sullivan County.

Harlem River & Port Chester.

This company has purchased twenty-eight lots of land on the southwest corner of Willis avenue and One Hundred and Thirty-first street, North New York, for $145,000; also, fifteen lots on the opposite corner for $30,000; likewise a plot, 100 by 125 feet, on One Hundred and Thirty-first street, near Willis avenue, for $60,000, making the total amount of $235,000. The above purchases are in addition to a frontage of 900 feet on the Harlem River previously owned by the company.

New Jersey Southern.

An act now before the Legislature authorizes this company to consolidate with any railroad in New Jersey, Delaware or Maryland, with whose road and branches it may now connect.

Virginia & Truckee.

The Virginia (Nev.) *Enterprise* says of this railroad: "While it is but 21 miles from this city to Reno by the wagon road, and perhaps not more than 17 'as the crow flies,' it is by the Virginia & Truckee Railroad 51¾ miles. For the first 21 miles, that is, till reaching Carson, the railroad runs southward, while Reno lies to the northward. Directly over the hills from this city to Steamboat Springs the distance is about six miles; by the way of the railroad it is 40¾ miles. From this it will be seen that the road in its course resembles a horse-shoe; but it must not be thought that it has the regular curve of a horse-shoe; on the contrary, it is full of the most remarkable sinuosities to be seen in any railroad in any part of the United States, if not in the whole world."

Ridgefield Park.

This company is to be consolidated with the Rockland Central Railroad Company, under the name of the Jersey City & Albany Railroad Company. The Ridgefield Park road extends from New Durham, N. J., four miles from Jersey City, north to the New York State line, and the Rockland Central Company proposes to extend it to Haverstraw, N. Y.

Cayuga Lake.

The stations on this newly completed road are as follows: Cayuga, Union Springs, Lewanna, Aurora, Long Point, Genoa, Atwaters, Lake Ridge, Taighannock, Lansing, Lake View, Ithaca. The road from Cayuga, N. Y., to Ithaca is about 40 miles long.

Buffalo, New York & Philadelphia.

A locomotive of the Baldwin "Consolidation" pattern, with cylinders 20 by 24 inches and eight driving wheels 52 inches in diameter, has been put upon this road. It is to be used in working the heavy grade from Emporium, Pa., to the Summit.

Stockton & Tulare.

This company, which filed its certificate of incorporation with the Secretary of State of California, February 3, proposes to build a narrow-gauge road from Stockton, Cal., south along the valley of the San Joaquin about 160 miles. The road will be about parallel with the Central Pacific Company's Visalia Di-

vision. The capital stock is to be $1,600,000, and the officers are: B. W. Bours, President; T. K. Hook, Treasurer; F. T. Baldwin, Secretary. Directors, E. F. Northam, of San Francisco; R. E. Hyde and E. Jacob, of Tulare; H. C. Dalton, Fresno; Charles M. Blair, Merced; A. Leach, Stanislaus; B. W. Bours, T. K. Hook, George F. Smith, R. C. Sargent and C. Grattan, San Joaquin County.

Baltimore & Ohio.

The last rail on the Metropolitan Branch, from Point of Rocks to Washington, was laid February 8. The ballasting on the road has been completed between Washington and Rockville at the south end of the road, and from Point of Rocks to the Monocacy at the other end, leaving only the distance between the latter point and Rockville to be ballasted. The company expect now to have the road in running condition by March 4, about which time trains will be put on.

Lake Ontario Shore.

Track-laying was to have been resumed February 8. A company is being organized to build a branch line from Charlotte, N. Y., south to Rochester. A branch line of the New York Central now connects the two places, to which the proposed line would be parallel.

Little Rock & Fort Smith.

It is reported than track-laying will shortly be resumed west of the present terminus.

Union Depot at Cincinnati.

The Cincinnati *Gazette*, of recent date, says: "At a meeting of the committee appointed to consider the matter at the Chamber of Commerce, a plan proposed by the Indianapolis & Cincinnati, Ohio & Mississippi, Dayton Short Line, and Marietta & Cincinnati (as reorganized), providing for a grand depot for the accommodation of those companies, extending from North Pearl to Columbia street, and Central avenue to Smith street, was submitted. This contemplates the vacation by the city of Smith street from North Pearl to Columbia, and the privilege of a track for two and a half squares on Columbia street to be used by the Ohio & Mississippi Company for passenger trains only. After an interchange of views, it was decided that a Union Depot, for the accommodation of all the railroads entering the city, is impracticable; that is to say, it could not be so located as to accommodate the East and West roads."

Washington & Ohio.

A compromise has been made between this company and the State of Virginia. The President of the company, in consideration of an extension of time—three years, in which the road is to be completed westward as far as Winchester—enters into an obligation by which he forfeits all the benefits of the amended charter, the State stock included, in case of a failure upon the part of the present company to comply with the above-named condition. He also pays the amount due the State, some $16,000.

Berks County.

The contract for the rails for this road has been awarded to Franklin Dundore, of Philadelphia. The rails are to be made by the Columbia Steel & Iron Company, and are to weigh 56 pounds to the yard.

Spartanburg & Union.

The purchasers of this road at the recent sale were Alfred Austell, Vice-President, and R. Y. McAden, a director, of the Atlanta & Richmond Air Line Company. The price paid was $308,000, of which $50,000 is to be in cash, the balance in three annual installments. The road was sold some time ago to Gen. Worthington for $450,000, but the purchase was never completed; hence the present sale.

Lancaster & Reading Narrow Gauge.

This company has executed a mortgage of $350,000 on its Quarryville Branch. The bonds will bear 7 per cent. interest, and David Bair, Amos S. Henderson and George K. Reed are trustees.

Erie—Newark Branch.

Preparations are being made to extend the telegraph line over this branch. It is much needed, as a single track only is used, and the running of trains is necessarily very irregular. It is said that the second track now laid will be put in good condition in the spring, and extended from Newark to Paterson. It is to be hoped that depot buildings will also be erected, only one station on the line (Newark) being now favored with any station accommodations, while at most of the stopping-places there is not even a platform.

Cumberland Valley.

Several meetings have been held for the purpose of making arrangements for merging this road in the Pennsylvania Railroad, but no definite conclusion has yet been reached. The Harrisburg (Pa.) *State Journal* says that it is anticipated that Mr. Thomas B. Kennedy will be appointed Vice-President and will be practically the head of the road, as the time of the President, Judge Watts, is entirely absorbed by his duties as Commissioner of Agriculture. It is reported that the people on the line are much dissatisfied with the present management.

Waco & Northwestern.

This road was sold at trustee's sale in Houston, Texas, February 4, and was purchased by Col. W. J. Hutchings, Vice-President of the Houston & Texas Central Company, for $400,000. The road extends from Bremond, on the Houston & Texas Central 143 miles northwest of Houston, in a northwesterly direction to Waco, a distance of 45 miles. It is operated as a branch of the Central road.

Vermont & Massachusetts.

At the annual meeting of this company, held at Fitchburg, Mass., February 12, there was a very lively discussion on the proposed consolidation of the lines leading from Boston to the Hoosac Tunnel. The general feeling was in favor of a consolidation with the Fitchburg Company, but that with the Boston & Lowell Company was generally denounced. After much opposition, resolutions were passed authorizing the board of directors to enter into negotiations with the Fitchburg, the Boston & Lowell and other connecting roads for consolidation or the lease or sale of the road.

Atlantic & Pacific.

A committee of the Missouri Legislature is now investigating a number of charges made against this company for alleged mismanagement of its own and the Missouri Pacific roads, and for overcharges and discriminating charges on freight. The committee has taken a great deal of testimony on the condition and working of the road under the former and present management, but no conclusion has yet been reached.

Chicago & Northwestern.

The Omaha and Dubuque trains, which heretofore have left Chicago at 10:30 o'clock both night and morning, now leave at 10:15.

Railroad Bills in the New Jersey Legislature.

The through railroad bills in the New Jersey Legislature seem to have brought about a dead-lock between the two Houses. The Assembly passed the New York & Philadelphia charter, which is the National bill, by a vote of 41 to 18, on the evening of the 17th, and on the same evening the Senate passed the New Jersey Railway charter, the Pennsylvania Company's bill, by a vote of 11 to 9, one Senator (who is understood to be opposed to the bill) not voting. It is feared that neither House will recede, and that both bills will fail. The feeling against the monopoly is said to be growing daily stronger, especially in the northern part of the State, and while the lower House is not at all likely to pass the Pennsylvania bill, it is possible that at least one Senator, moved by the fear of future political retribution, may change his position far enough to vote for the National bill. The two bills are exactly the same, with the exception of the names of the incorporators.

Boston & Albany.

The annual meeting was held in Boston, February 12. No business of importance was transacted, further than the passage of resolutions expressing confidence in the present management. Resolutions were offered by a stockholder, expressing the opinion that the so-called "tunnel line" should be consolidated with the Boston & Albany, but they were promptly tabled.

Milwaukee & St. Paul.

This company has perfected its arrangements for the running of passenger trains into Chicago, and it began to run the first regular trains into the city on Monday, February 17.

Canadian Pacific.

The contract for the construction of this road was signed at Ottawa, Can., February 5. The company, the organization of which has been already noted, agrees to construct the road and is to receive a subsidy of $30,000,000, payable in monthly installments as the work progresses, and also a grant of 50,000,000 acres of lands in Manitoba, British Columbia and the Northwest. The capital of the company is $10,000,000, and cannot be increased except by act of Parliament. The directors are also authorized to issue bonds to the extent of $40,000 per mile, to be a first charge on the assets of the company. Ten per cent. of the capital stock is to be placed in the hands of the Receiver-General as security for the performance of the contract.

The road is to be divided into five sections, as follows:

The Eastern Section, extending from the eastern terminus to Red River: the Lake Superior Section, extending from some point on the Eastern Section to Lake Superior; the Central Section, extending from Red River to a point in the longitude of Fort Edmonton; the Manitoba Section, extending from the main line in the Province of Manitoba to the boundary of the United States; and the Western Section, extending from a point in the longitude of Fort Edmonton to the Pacific coast.

The company shall within two years from the 20th day of July, in the year 1871, begin simultaneously the construction of the railroad from the Pacific Ocean toward the Rocky Mountains, and from a point in the Province of Ontario, hereafter to be determined by the Government, toward the Pacific Ocean, to connect the seaboard of British Columbia with the railway system of Canada; and, further, shall construct the Manitoba Section by the 31st of December, 1874; the Lake Superior Section, and such portion of the main line as shall be required, to complete communication between Lake Superior and Red River, by the 31st of December, 1876; shall proceed with and construct the eastern and western sections simultaneously; shall prosecute the work of constructing the railway with all due diligence, and shall complete the whole railway within ten years from the said 20th day of July, 1871, unless the last-mentioned period be extended by Parliament, in whose care the company shall complete the whole railway within such extended period.

The road is to be built according to specifications agreed upon by the company and Government, and provision is made for a board of arbiters to consist of three engineers, which will settle disputed points. The Union Pacific road is fixed as an approximate standard by which such matters are to be regulated.

A board of three trustees, one chosen by the company, one by the bondholders and one by the Government, will have control of the moneys and investments of the company. If work is not commenced by January 1, 1874, the Government may, in the following May, cancel the charter.

New Bedford.

The New Bedford Railroad Company, which is to take the place of the New Bedford & Taunton Company under the agreement lately made with the Boston, Clinton & Fitchburg Railroad Company, has been organized, the act incorporating the company having become a law. The stockholders of the New Bedford & Taunton Company have the privilege of taking two-fifths of the stock of the new company, of which privilege, it is said, they will generally avail themselves.

Cairo & Vincennes.

The office of the General Superintendent has been removed to Cairo, Ill., with the General Freight and Ticket Agent's office.

This company, according to the time-table of February 2, had one passenger train running through between Cairo and Vincennes; a freight train running between Cairo and Carmi, 100 miles, and a freight train between Vincennes and Carmi, 56 miles. There is also an accommodation train between Cairo and Mound City, 5¾ miles.

Levis & Kennebec.

This road is to extend from Levis, on the St. Lawrence opposite Quebec, south up the Chaudiere River to the Maine frontier, a distance of about 90 miles. The road is graded and ready for the rails for 27 miles from Levis. The northern end of the line passes through a well-inhabited farming country, while the southern end is in a heavily timbered region, which is expected to give the road a large traffic in lumber.

Illinois & St. Louis Bridge.

Preparations are being made to raise the superstructure of the bridge. The heavy frame-work on the west abutment, over which will pass the cables used to support the steel arch as it advances towards the center of the span, has been erected. About 4,800,000 pounds of the steel to be used has been delivered in Pittsburgh, and most of it transported to East St. Louis. The final estimates for the masonry have been made and the contractor settled with. The cost of the masonry was about $1,000,000.

Placerville & Sacramento Valley.

The city of Placerville, Cal., several years ago issued its bonds in aid of this company. The road was never completed to Placerville, and payment of the interest has been refused. Recently suit was brought to compel the city to levy a tax for the payment of the interest, and a writ of mandamus was issued to compel the board of aldermen to vote such a tax, but the entire board resigned before the order could be served.

Southern Maryland.

The State Treasurer of Maryland has, for the State, subscribed $163,000 to the stock of this company.

Baltimore & Drum Point.

On the recommendation of the Commissioners of Calvert County, the Treasurer of the State of Maryland has subscribed $152,000 to the stock of this company, on behalf of the State.

Maryland Central.

This company having asked the City Council of Baltimore to repeal the ordinance passed by a preceding Council which withdrew the endorsement of the city from the company's bonds, the law officers of the city have decided that such a repeal would amount to a re-enactment of the original act endorsing the bonds, and would not be valid unless the question was submitted to a popular vote, as the original ordinance was.

A Discussion of the Gauge Question.

Mr. W. W. Evans, of New York, has recently published a pamphlet on this question, which is, for the most part, made up of the following letter from Mr. B. H. Latrobe, whose long experience, great skill and good judgment in his profession, and fairness of mind, give peculiar weight to his opinions:

BALTIMORE, November 8, 1872.

W. W. EVANS, ESQ., Civil Engineer:

DEAR SIR—I have to thank you for a copy of the pamphlet containing your letter of June 3, 1872, to the Right Hon. H. C. E. Childers, M. P., Agent General of the Colony of Victoria, on "Railway Gauges and Construction, Machinery, Economy, &c." I have read it with interest and attention; and as you have expressed a wish to learn my views upon the subjects of which it treats, and especially upon that of "railway gauges," I take the earliest leisure at my disposal to comply with your request. As I have until recently, however, given no special attention to that subject, I have turned to the professional journals, and to some pamphlets, kindly sent to me by friends, in order to inform myself better, as to its present position. I find much has been said and written in regard to it, so much indeed that it would be difficult for me to compress into a moderate compass all that it occurs to me to express in connection with it. I shall, there ore, be obliged to confine myself, for the present at least, to some remarks of a somewhat general character and touching only upon the leading points of the case.

GAUGE QUESTION IN EUROPE AND AMERICA.

The gauge question, as is well known, was many years ago, in England, the subject of a controversy so warm between the engineers of that country, as to be called the "Battle of the Gauges." It never assumed in America so fierce a character; yet there arose so much discussion upon it here, as to lead to the adoption of several varieties of gauge in different sections of the United States. What is now known as the "standard gauge of 4ft. 8½in." came to us from England in 1828, and was quietly adopted by us without question, and had not Brunel, a few years afterwards, carried his bold expansion of it upon his own work up to 7 feet (we never went beyond 6 feet here), we should probably have adhered to the narrower and more judicious width established by the elder Stephenson. It would have been well had we done so, for among the various advocates of different gauges there can be but one opinion as to the advantages of perfect uniformity, were it readily practicable now to bring it about by selecting some one of the different gauges and bringing all the rest to conformity with it. Great, however, as are the admitted mischiefs of the present variety of gauges, there has arisen within the last year or two a party proposing still another gauge, and, in accordance with the tendency of our race to pass pendulously from one extreme to the other, it is now proposed to retreat nearly as far *within* the standard as Brunel ventured beyond it. In this new movement in the railway world I cannot help recognizing an analogy with the founders of new sects in our religion, who, in their opposition to "sectarianism," forget that they are only increasing the number of sects by the one which they set up.

DISAGREEMENT AMONG THE NARROW GAUGES.

The champions of the new or "narrow gauge," as now named, are indeed not agreed as to which is the best among those which are suggested and which range from 2 feet (omitting fractions of an inch) up to twice that width. As in America, however, the mean between these limits (3 feet) appears to be the favorite, it may be taken as the one between which and the standard, 4ft. 8½in., the comparison is to be made here.

THE OBJECT OF THE NEW GAUGE.

Our first inquiry now is, what is the object which the narrow-gauge party propose to attain? Their answer is, economy of *construction*, *maintenance* and *working* in the railway system. An unexceptionable object, undoubtedly; but then this word *economy* has in this connection a more complex meaning than is conveyed by the word "cheapness" in its simplest sense—that is, smallness of pecuniary outlay; just as a rich man may live in splendor and yet be economical, that is, not wastefully extravagant, so may a railway be constructed not only substantially in its road, bridges and tracks, but handsomely in its station houses and other buildings, and be operated with elegantly furnished cars and engines, and yet be economically built and managed. The *means* and the *tastes* of the people for whose use it is constructed and worked enter largely into consideration in determining the character of the work.

WHAT HAS MADE THE RAILWAY WHAT IT NOW IS.

Now if we look back through the five-and-forty years of our railway history, and trace it from its weak and humble beginning up to its present period of strength, pride and expansion, we discern in it a chain of cause and effect which accounts clearly for the condition which it has attained and which has not yet reached its climax of power and magnificence. Anything which is the result of so slow and gradual a growth as this system must have elements of stability in it which cannot fail to insure its permanence. Hence I argue, upon the broad principles which govern the sentiments and conduct of civilized nations, that none of the comforts, conveniences and luxuries which have, one by one, been added to railway traveling, and none of the speed and safety realized by railway transportation of freight during all these years will be given up in the future in order to promote what is called "economy." The people of the country feel that they can afford them—that they have become indispensable to them. They therefore *demand* them, and the railway companies find themselves compelled to *supply* them. Not only in the railway but in architecture, furniture, dress and mode of living the same tastes are displayed and the same determination to gratify them.

WHAT WOULD WARRANT A CHANGE IN ITS CHARACTER.

These positions would hardly, I presume, be contested, and they make out a *prima facie* case in favor of the present manner in which railways are constructed and worked in this advanced day of national and individual wealth. The more enthusiastic of the narrow-gauge advocates, however, aver that all these objects can be *sufficiently*, if not as *fully*, secured by a 3-feet gauge, and at a vast reduction in cost, and this averment would raise the sole issue as to what the gauge should be if the first railway had yet to be constructed. Happily that is not the case, or the world would have progressed far less than it has upon the path of high civilization, and the question now is, whether a new gauge should be introduced, even if a better one, seeing that Europe and America are already reticulated by a different one with which there could be no suitable connection.

The saving in cost of construction and operation must be large indeed, to justify its introduction even in places isolated at present from existing roads, but which may be brought into the system at a future time. The narrow-gauge advocates accordingly claim that the saving *will* be large beyond all measure, so large indeed as to overbalance all the inconveniences of a broken gauge, and the accompanying cost and delays of transhipment.

DISCUSSIONS IN THE RAILROAD PERIODICALS.

Upon this question of construction and operation, of which

I will now speak, some articles, illustrated by diagrams, have appeared in the RAILROAD GAZETTE, designed to show that the "standard gauge" admits of being built and worked nearly, if not quite, as cheaply as the 3 feet, and the case is pretty well made out. The views of the author have been contested by other contributors to the paper, who have also supported their side by drawings and computations upon formulæ framed for the purpose. It is not, indeed, so easy to compare the results, as the data as to breadth of road-bed, etc., are not altogether the same, but, on the whole, the standard-gauge disputant comes much the nearest, I think, to proving his points.

LARGE CLAIMS OF THE NARROW-GAUGE ADVOCATES.

In the several pamphlets which I have read, the assumptions as to savings in cost seem to be of the very boldest character, and are supported in very few instances by any attempt at proof. Their cool confidence is really amazing, and in some cases quite amusing; where, for instance, a narrow-gauge road is alleged to have actually cost but two-ninths of the estimated cost of a standard-gauge in a particular locality (between Pine Bluff and Nevada). It is true that, in that case, the location of the two were admitted, upon inquiry made of the engineer, to have been quite different, the standard-gauge line being laid out with no curve of less radius than 955 feet, while the narrow-gauge was constructed with a minimum radius of but 220 feet, and with some considerable economy of first cost resulting, as may be well imagined. The engineer consoles himself with the reduction of grade consequent upon the elongation of distance (to what extent we are not informed) attendant upon the employment of such curves by which all the sinuosities of the "cañon" would be faithfully followed and the expense of graduation reduced to a minimum—that is, from $90,000 down to $20,000 per mile. In such a case as this, the ground occupied being so wholly different, there can of course be no fair comparison of results, the questions between tractional resistance and power employed to overcome it, speed and safety of transit, wear and tear of road and train, etc., complicating it so completely as to forbid a reliable balance of accounts. The engineer stating that on the estimated standard-gauge line there were numerous tunnels and bridges across the stream flowing through a cañon 3,000 feet deep with precipitous sides, all of which costly work the narrow-gauge road avoided, we may guess how exceedingly winding its course must have been to have reduced its cost to the above stated proportion of the other, even after allowing for the proposed saving in the track by much lighter cross ties, rails, etc., etc. Another engineer makes the narrow-gauge upon another line (the Memphis & Knoxville) cost but 60 per cent. of a 5-feet gauge, and still another engineer, upon another road (Golden City & Black Hawk) only 40 per cent. of the standard gauge; and so the several advocates of the new gauge claim reductions varying according to the grades and curves employed, the character of the ground occupied and their own respective views upon the different elements of the question.

The details of these various estimates are not, indeed, given so fully as to permit a complete analysis of them and consequent conclusions as to their correctness. It is sufficiently apparent, however, that the *dimensions* of all parts of the two gauges compared must be considerably different even when their locations are the same. Before offering, however, farther remark upon the question of first cost of construction, I would refer to the "interrogatories" propounded in your letter to Mr. Childers, which bring up most or all of the points of inquiry as to the merits of the competing gauges, and to which I am indebted for many valuable hints for the treatment of the subject.

Among the questions* (44 in number) there are several which, as I conceive, can be answered in but one way by both sides alike, viz.: questions 1, 3, 4, 6, 12, 25, 32, 35, 36, 37, 39, 40 and 43. A number of others of the series admit almost as little room for difference of opinion, but I will touch upon the subjects of them, in such manner as their relative importance may seem to require.

IS A NARROWING OF THE GAUGE NECESSARY TO THE OBJECTS AIMED AT BY ITS FRIENDS?

I would first observe that, considering that a reduction in the cost of constructing and operating railways, as at present built and worked, is desirable if it could be accomplished without sacrificing other objects which have come to be indispensable, whether rightly so or not, the main question is whether the reduction of the standard gauge to some one of the newly proposed narrow gauges is necessary to the attainment of that end. The advocates of the reduced gauge insist that it is, and so raise the issue which we will examine, in doing which the 4ft. 8½in. and the 3-feet gauges will be the ones compared. We will first, then, assume that the cars and engines of the standard gauge remain unchanged in their dimensions of length and *breadth*—especially the latter, as that has most to do with the gauge question.

EXTENT TO WHICH REDUCTION OF GAUGE WOULD EFFECT SAVINGS.

Railway works consist of road-bed (embracing excavation, including tunneling), embankment, masonry (of bridges, culverts and tunnels), superstructure of bridges and track (including ballast, cross ties, rails and fastenings), water-houses and tanks, engine houses, machine shops and station buildings. Let us see, then, to what extent the cost of each of these items can properly be lessened by the reduction of gauge from the standard of 4ft. 8½in. to 3 feet.

GRADUATION—WIDTH OF CUTTINGS, EXCAVATIONS, EMBANKMENTS AND TUNNELS.

Upon lines of equal length and the same longitudinal profile, any reduction in quantities must be due to one in *breadth*. On examining this point with care, I find that in *cuttings* of ordinary depth, material and need of drainage, the width of road-bed *at grade*, should not be *less* than 12 feet for the 3 feet and 14½ feet for the 4ft. 8½in. gauge, for one track, and 21 feet for the former, and 26 feet for the latter, with two tracks.

WIDTH OF EMBANKMENTS.

Upon embankments the narrow gauge should have a top breadth of 12 feet and the standard 12.7 for single, and 21 and 25.2 feet respectively for double track.

In *tunnels* the same differences necessary in cuttings, of 2½ feet for single and 5 feet for double track (the heights of roof the same), would be required. I have obtained these figures by allowing outside widths of 7 and 9½ feet for the cars of the two gauges, with a space of 2 feet clear between cars. This is not allowed upon all standard gauge roads, but *should* be, as well as upon narrow gauges. It requires 6¾ feet between tracks instead of 6 feet on standard, and 6 feet on narrow gauge instead of 5 on adjacent tracks, and 2½ feet between outside of cars and sides of cuttings and tunnels (at *grade*, the slopes increasing in cuts) and on embankments 4½ feet between inner edge of rails and edge of bank. The difference on embankments is less than in cuttings, owing to the absence of lateral limits for which clearance must be provided.

The width of 12 feet above assumed for narrow gauge, single track, in cuttings and embankments, is the same with that adopted upon the "Denver & Rio Grande Railway" for *cuttings*, but upon that work, now under construction, the embankments are made but 10 feet 3 inches top width. Now the excess of width upon embankments—beyond a mere support for the track—is required, not for clearance from slopes, &c., as in cuttings, but for marginal allowance for slides and washes, derailment of trains, and room for material and work of track repairers. This margin—measured from inside of rails—I have made 4½ feet. Mr. John B. Jervis, in his excellent little work on "Railway Property," argues, with good reason, for at least 5 feet, and this will be independent of gauge and number of tracks. It is true we often see this margin reduced to nothing, outside of the crossties or ballast; but it ought not to be so upon a well maintained road-bed, and such we are now dealing with.

* Published in the RAILROAD GAZETTE of August 10, 1872.

LOCOMOTIVE RETURNS, SEPTEMBER, 1872.

Master Mechanics of all American railroads are invited to send us their monthly reports for this table.

NAME OF ROAD.	Number of miles operated	Number of Locomotives in service	MILEAGE. Passenger	Freight	Miscellaneous	Total	No. OF MILES RUN TO Ton of Coal	Cord of Wood	Pint of Oil	COST PER MILE, IN CENTS. Repairs	Fuel	Stores	Miscellaneous	Engineers, firemen and wipers	Total	AVERAGE COST OF Coal, per ton	Wood, per cord	Oil, per gallon
																$	$	$
Burlington & Missouri River	.....	66	51,586	96 723	62,603	210,912	38.79	60.73	14.78	4.36	6.66	0.62	....	7.40	19.04	2.50	4.00	....
California Pacific	148	10	11,120	10,731	2,950	24,801	.....	45.49	15.36	6.18	10.95	0.95	....	6.46	24.53	.....	5.00	....
Central Pacific	1,112.7	163	105,641	226,753	91,940	427,334	44.65	34.73	13.57	10.31	18.00	0.96	....	6.87	36.14	9.23	4.29	....
Chicago, Rk. Isl. & Pacific (Ill. Div.)	.....	73	33,937	143,700	4,531	187,168	41.64	.....	17.32	3.59	6.83	0.59	....	6.78	17.79	2.75	4.00	....
" " " (Iowa Div.)	.....	105	71,316	155,692	42,023	268,431	42.07	.....	14.72	3.49	6.71	0.63	....	6.32	17.65	2.75	4.00	....
Clev., Col., Cin. & Indianapolis	475	133	70,227	217,301	106,766	394,354	49.70	.....	9.88	3.36	5.27	0.67	....	7.21	16.45	2.62	.....	....
Cleveland & Pittsburgh	.....	84	.....	.....	.....	265,418	50.58	.....	18.73	2.49	4.72	0.61	....	7.10	14.93	2.25	1.95	....
Denver Pacific	.....	...	12,033	4,566	1,199	17,798	50.17	.....	31.13	3.77	7.05	0.56	....	6.97	18.35	3.50	6.77	....
Flint & Pere Marquette	.....	27	19,491	27,894	17,715	65,070	.....	62.06	25.83	2.70	7.25	0.82	....	7.05	17.82	.....	4.50	....
Hannibal & St. Joseph	.....	64	31 964	97,737	29,050	158 751	47.50	.....	20.20	5.70	6.00	0.90	....	7.29	19.50	2.50	5.00	....
Kansas Pacific	.....	...	61,028	101,322	39,622	201 972	43.73	.....	12.86	6.28	9.20	0.66	....	7.15	23.29	4.00	3.23	....
Lake Sh. & Mich. Sou. (BuffaloDiv.)*	.....	21	24,910	113,530	74,490	213,330	49.00	.....	12.60	5.07	7.10	....	....	6.50	13.60	3.50	3.50	....
" " " " (Erie Div.)*	.....	90	41,339	133,696	61,137	241,272	45.00	36.00	17.00	4.39	8.04	....	....	7.02	19.45	3.50	4.00	....
" " " " (Toledo Div.)*	.....	76	42,280	126,020	36 550	204,850	52.54	53.89	14.08	3.22	7.55	....	....	5.46	17.23	4.00	4.00	....
" " " " (Mi.So. Div.)*	.....	165	121,605	204,438	186,509	512,702	48.63	50.84	13.63	5.12	7.33	....	....	5.52	18.02	4.50	3.50	....
																p. bu.		
Louisville & Nashv. (Main Line)	356	100	69,815	123,300	6,630	204,745	32.40	.....	11.71	6.73	13.13	0.69	0.83	3.93	30.42	0.12	3.50	....
" " (Clarksville Div.)	123.4	6	75	7,043	1,526	9,738	.....	.....	13.90	7.60	9.91	0.32	1.93	5.16	24.90	.....	2.65	....
" " (Memphis Div.)	130.4	20	19,051	24,541	3,705	47,337	.....	32.00	11.40	3.29	10.14	0.78	1.34	3.47	24.99	.....	3.00	....
" " (Decatur Div.)	122	21	13,808	6,849	1,207	26,864	.....	.....	11.91	6.77	9.36	0.75	0.73	3.10	23.71	0.15	3.50	....
																p. ton		
Leavenworth, Lawrence & Galveston	206.6	16	16,273	18,396	3,646	38,315	76.22	.....	27.37	3.14	4.90	0.50	....	7.53	16.07	3.50	2.50	....
Marquette, Houghton & Ontonagon†	.....	17	.....	.....	.....	41,337	69.91	.....	17.70	4.57	3.29	0.85	....	3.59	22.30	2.00	5.20	....
																p. bu.		
Pennsylvania (New York Division)	.....	101	134,213	98,649	13,200	246,062	41.89	36.23	8.95	5.99	13.50	1.30	....	....	20.79	0.18	6.00	....
" (Amboy Division)	.....	55	55,826	47,432	4,571	107,889	45.99	62.87	14.33	7.20	10.40	0.90	....	....	18.50	0.18	6.00	....
" (Belvidere Division)	.....	32	20,411	28,190	4,821	53,420	43.45	50.25	14.20	4.00	12.30	1.20	....	....	17.50	0.18	6.00	....
" (Philadelphia Div.)	.....	132	75,175	242,184	11,117	328,476	34.88	.....	17.13	5.18	6.20	0.90	....	....	12.20	0.07	3.60	....
" (Middle Division)	.....	122	62,096	259,479	12 267	333,842	30.46	.....	22.03	4.70	6.30	0.70	....	....	12.30	0.07	3.60	....
" (Pittsb'g Div., E. End.)	.....	84	16,036	141,189	4,263	161,494	24.63	.....	12.66	6.40	8.40	1.00	....	....	15.80	0.07	3.60	....
" (Pittsb'g Div., W. End.)	.....	103	63,081	175,321	11,046	249,448	35.20	.....	17.01	5.90	6.10	0.80	....	....	12.80	0.07	3.60	....
" (Tyrone Division)	.....	27	11,064	35,616	2,620	49,300	30.81	.....	23.74	9.50	7.00	0.70	....	....	17.20	0.07	3.60	....
" (West Penn'a Div.)	.....	23	15,931	35,290	2,992	54,113	39.63	.....	23.03	5.30	5.20	0.50	....	....	11.00	0.07	3.60	....
" (Lewistown Division)	.....	9	7,010	7,853	1,690	16,553	51.11	.....	21.74	11.70	4.20	0.70	....	....	16.60	0.07	3.62	....
" (Bedford Division)	.....	5	2,353	2,019	1,200	5,572	50.92	.....	12.39	51.20	4.70	0.80	....	....	56.70	0.07	3.51	....
																p. ton		
Pittsb'g, Ft. Wayne & Chic. (E. Div.)	319.2	149	77,734	319,061	9,400	406,255	41.90	.....	13.66	2.01	6.24	0.93	0.96	7.27	17.21	2.50	3.54	....
" " " " (W. Div.)	280	100	82,762	197,314	26,415	306,437	70.30	29.50	17.45	3.39	9.49	0.59	....	6.89	20.09	2.25	3.25	0.60
Pitts., Cin. & St. Louis (Lit. Miami Div.)	.....	39	49,982	46,711	3,465	100,158	42.80	.....	11.15	5.49	6.70	0.50	2.30	7.80	23.70	2.8	3.30	....
San Francisco & North Pacific	38	3	4,110	3,650	2,050	9,810	.....	42.10	13.23	2.83	11.37	0.37	....	5.29	20.91	....	5.00	....
South Carolina	.....	39	15,339	43,025	13,474	71,838	.....	48.75	30.49	5.66	4.94	0.77	....	....	11.37	.....	2.42	....
Springfield & Illinois Southeastern	.....	14	19,179	11,378	4,670	35,527	59.20	43.00	13.70	2.69	3.84	....	....	8.94	15.47	.....	.....	....

YEAR ENDING AUGUST 31, 1872.

Hannibal & St. Joseph	.....	77	511,974	1036,039	306,449	1854,462	46.60	.....	20.70	3.20	6.30	0.90	....	7.40	22.80	2.57	5.00	....

* Switching Engines allowed six miles per hour

† 0.74 lbs. sand used per mile run.

In applying these breadths of road-bed, for comparison of the relative cost of earth and rock work on the two gauges, it must be remarked that the *proportional* increase upon the wider gauge will be most against it where the depths of cuttings and filling are small; but the *absolute* addition to its expense will, of course, be less.

Thus for a cutting of say 6 feet and slope of 1 to 1, the sectional area of a 12 feet road-bed will be 108 square feet, and of a 14½ feet road-bed 123 square feet, the latter the greater by 15 square feet, or about 14 per cent. of the former; while for a cutting of 60 feet, the area would be 4,320 and 4,470, difference 150, or only 3½ per cent. Upon embankments of similar heights the difference would be 10.2 and 102, or 8 and 1¼ per cent. respectively. I notice this point because I observed that in comparing the cost of graduation on the two gauges, the per cent. of increase was referred to as a general term of comparison without regard to depth of cutting or filling.

The heavier the work, therefore, the less will be the comparative increase of cost upon the standard gauge, although the contrary seems to be assumed by some of the friends of the narrow gauge.

In order to make some general comparison of the cost of graduation on the two gauges, we must assume some average cutting and filling, and to simplify the calculation let us suppose that the linear extent of cut and fill is alike on each mile, and that the excavations in the road-bed exactly balance the embankments, without waste or borrow. As the slopes of the latter are usually flatter than those of the excavations, a little increased average depth of cuttings over filling will be required to effect this balance, making no allowance for swell or shrinkage of material.

Now taking two characters of line, a light one with an average depth of cutting of 5 feet, and a heavy one with an average cut of 20 feet for half the length of the mile, the following would be the number of cubic yards per mile on each gauge respectively, with 1 to 1 slopes:

	Single track. ft. wide,	cub.y's,	Double track. ft. wide,	cub.y's.
5 ft. cut standard gauge,	11½	9,533	26	15,155
" narrow gauge,	12	8,311	21	12,712
Excess on standard,	15½ per ct.	1.222	19¾ per cent	2.444
20 ft. cut stand'rd gauge,	11½	67,466	26	89,955
" narrow gauge,	12	62,577	21	80,177
Excess on standard,	7 8-10 per ct.	4,889	12 2-10 per ct.	9,778

At an average cost per cubic yard of 30 cents (as the slopes assumed being 1 to 1, the material is supposed to be ordinary earth, and we will suppose the haul to be a short one on account of frequent alternation of cutting and filling), the difference against the standard gauge would be, upon the *light* line, $366 per mile for single track and $733 for double track; and, upon the heavy line, $1,468 for single and $2,936 per mile for double-track road-bed.

COMPARISON WITH ESTIMATES OF NARROW-GAUGE ENGINEERS.

In a pamphlet recently published and containing with other documents, the "Proceedings of the National Narrow-Gauge Railway Convention, held in St. Louis, June 19, 1872," there is an estimate of cost for the "Memphis & Knoxville Railroad" of 30 miles in length, by Mr. Millington, its Chief Engineer, upon two gauges, one of 5 feet, and the other of 3 feet. The number of cubic yards of earth excavation for the 5-feet gauge is estimated at 461,150, or 15,732 per mile, and for the 3-feet gauge at 244,200, or 8,140 per mile. Now if, in accordance with the data used in the preceding computation, we consider these quantities per mile to be the sum of the excavations upon half of the mile, and as making the embankments upon the other half, we shall have an average area for the 5-feet gauge line of $\frac{461,150}{1,760 \times 3} = 87.46$ square yards, and for the 3-feet guage line of $\frac{244,200}{1,760 \times 3} = 9.25$ square yards. The slopes being 1 to 1, we get the average depth of cutting from the formula $a = (b+d)d$, whence we have the equation

$$d = \sqrt{a + \frac{b^2}{4}} - \frac{b}{2}$$

where d is the depth sought, a the area known and b the known breadth. Applying this equation to the 3-feet gauge, where the breadth is presumed to be 12 feet, we obtain an average depth of 1.64 yards, or 4.92 feet. If, then, the location of the two lines was precisely the same as to grades and curves and horizontal and vertical position in all respects, which, must be presumed, or the comparison would not be a fair one (and must have been the fact as the length of the lines—30 miles—was the same) the average depth of center cutting must have been the same, and the breadth of road-bed, in that case upon the 5-feet gauge line must have been:

$$b = \frac{a - d^2}{d} = \frac{17.46 - 1.64^2}{1.64} = 9 \text{ yds. or } 27 \text{ ft.}$$

or 2¼ times the breadth of the 3-feet gauge road-bed.

This result is so very greatly at variance with that of the calculation I have submitted for a similar depth of cutting, and based upon a road-bed of 14½ feet width, for the standard gauge of 4 ft. 8½ in. (and which for a 5-feet gauge would be but three-tenths of a foot more, or 15 feet), that I must suppose some other element enters largely into the estimates of Mr. Millington. I might *conjecture* that he assumed not only a much wider road-bed for the 5-feet gauge than I have, or than was at all necessary, but that the whole excess of width over his 3-feet gauge was thrown into steep natural slopes of cutting (instead of being divided between the two sides of the center); but, from his general description of the character of his line, I would not infer that such slopes were encountered.

At all events, he makes the graduation of his 30 miles of road, single track, upon the two gauges, cost, at the same prices, per cubic yard, the difference between $138,345 and $73,260 = $65,085, or $2,169 per mile, in favor of the narrow gauge, while I would make it the difference between $85,797 and $74,799 = $10,998, or $367 per mile; or, adding (at the rate of 147 cubic yards per mile for the 3¼ inches difference between 4 ft. 8½ in. gauge and 5-feet gauge—2,205 cubic yards for the whole 15 miles of cutting) $662, the difference would become $11,660, or $389 per mile in favor of the 3-feet over the 5-feet gauge.

I have presented these comparative estimates of the cost of graduation in detail, as they seem to throw light upon the manner in which the present warm advocates of the narrow gauge reach conclusions so favorable to the system they have espoused with so much ardor. The same price per cubic yard has been used in the estimates; but I would remark that the wider excavation is always entitled to a reduction of price, as it affords more room to work, as the slopes are common to both widths, and the dressing of them is a considerable element of expense, as contractors well know.

Passing by for the present the minor items of bridging, piling, trestling, culverts, cattle guards, &c., I remark that the next most important, in Mr. Millington's estimates, are those of the superstructure, or railway track; and on these some remarkable differences, as between the two gauges, are to be seen. The amount of trade and travel must, of course, be taken to be the same in both cases, and the 3-feet gauge is assumed to carry it upon a track to cost a trifle more than half that of the five-feet gauge. The narrow-gauge rail is put at 30 pounds, the wider gauge at 60 pounds per yard; while the cross-ties, spikes and track-laying of the former are estimated at about three-fourths, and the joint fastenings at two-thirds in cost of these of the latter gauge. Now, one would think that it could scarcely be contended by the most eager partisan of the narrow-gauge, that upon a rail of 60 pounds so supported and fastened no more business could be done than upon one-half of the weight, making a track of little more than half the breadth; such, however, is, in fact, the sort of position taken by the zealous supporters of the new system, and they justify it by claiming a vast reduction of *dead weight*, as compared with paying weight; that is, they claim that the same net loads can be carried, and the same gross revenue can be earned, by trains composed of engines and cars so much lighter than those now required on the wider gauges that a structure correspondingly lighter in all its parts, will do the business with a corresponding reduction of expense, and hence realize the same profit upon a greatly reduced outlay.

[TO BE CONTINUED.]